Snake River - Hells Canyon Total Maximum Daily Load (TMDL)

Section 4.0 Load Allocations

4.0 Load Allocations

Pollutant sources, load capacities, and pollutant loading have been discussed in detail in the preceding pollutant-specific sections. This section contains a summary of all load allocation information on a pollutant-specific basis. The pollutant load allocations assessed include a margin of safety to take into account seasonal variability and uncertainty. It is acknowledged that uncertainty may be attributed to incomplete knowledge or understanding of the system, incomplete data, or variability in data.

Allocable loads were identified using a combination of information including pollutant loading, margin of safety, natural loads, and reserve capacities as appropriate. As discussed previously, appropriate margins of safety were used in determining load capacity for all pollutants for which a TMDL was completed. Natural pollutant loading was recognized and quantified to the extent possible in all cases. Reserve capacities were recognized for point sources for those pollutants where such capacities were appropriate. Load allocations were then determined using the remaining load capacity for each SR-HC TMDL segment.

For the purposes of the SR-HC TMDL, "point sources" refer only to those permitted facilities that discharge directly to the mainstem Snake River within the SR-HC TMDL reach (Section 3.0). These sources as listed in Table 2.5.0. Point sources that discharge to the tributaries will be accounted for in the tributary TMDL processes. Point sources that discharge to the mainstem above or below the SR-HC TMDL reach will be accounted for in the separate TMDL processes for the Snake River segments into which they discharge.

Tributary inflows to the SR-HC TMDL reach have been treated as discrete, nonpoint sources for the purposes of loading analysis and allocation within this TMDL. Gross allocations have been assigned to each inflowing tributary. Existing or future tributary TMDL processes will distribute load allocations in the form of load allocations and/or waste load allocations within their specific watersheds. It should be kept in mind that while inflowing loads to the SR-HC TMDL reach represent nonpoint sources within the SR-HC TMDL framework, actual tributary loading is composed of both point and nonpoint discharges within the respective tributaries. In some tributary watersheds, point source discharges from municipalities or industries combine with nonpoint discharges from agricultural and rural stormwater in the river channel as flow moves downstream. All of these will be represented as nonpoint source loading to the Snake River for purposes of the SR-HC TMDL.

In some cases, tributaries to the Snake River – Hells Canyon TMDL have been assigned load allocations for pollutants for which the tributaries do not have 303(d) listings.

In the case where a TMDL for other pollutants is already in place (Payette and Boise Rivers), IDEQ will prepare a tributary-specific TMDL through the existing tributary TMDL process as part of the Implementation Plan for the approved TMDL. This TMDL will be written as an extension of the SR-HC TMDL process, but will utilize the WAG and other technical and stakeholder groups that participated in the preparation of the tributary TMDL.

In the case where a TMDL is not already in place (Weiser, Owyhee and Malheur Rivers), IDEQ will prepare a tributary-specific TMDL through the existing tributary TMDL process as part of the scheduled tributary TMDL. This TMDL will be written as an extension of the SR-HC TMDL process, but will utilize the WAG and other technical and stakeholder groups that participate in the preparation of the tributary TMDL.

The Oregon Department of Environmental Quality does not intend to list the tributaries to the Snake River/Hells Canyon TMDL for these pollutants. ODEQ, however, does intend to analyze pollutant levels and sources within the tributary subbasins and set allocations as appropriate as part of the development of TMDLs for the subbasins. The water quality management plan (WQMP) for the subbasins will also address implementation of pollutant load allocations as appropriate. If the analyses indicate that the target criteria for the inflow of the tributary to the Snake River cannot be achieved as a result of non-anthropogenic sources, the Department will, as resources allow, reopen the Snake TMDL and adjust the allocations accordingly, as appropriate.

It should be clarified that the allocations discussed in the following sections are based only upon an assessment of what is required to attain water quality standards in the mainstem Snake River within the SR-HC TMDL reach. This TMDL attempts no assessment of whether these conditions will attain tributary water quality criteria. Thus, it is possible that future tributary work could require reductions greater than those assigned in the SR-HC TMDL and could find conditions different from those assumed herein. In particular, the assumptions made herein regarding natural and anthropogenic contributions of heat in the tributaries are not to be assumed to be accurate for purposes of developing tributary TMDLs.

4.0.1 Mercury

Due to the fact that essentially no water column data are available to this effort, a TMDL cannot be established for mercury for the SR-HC TMDL reach. Therefore, IDEQ and ODEQ have determined it is in the public interest to reschedule the mercury TMDL for the SR-HC TMDL reach. IDEQ will reschedule the mercury TMDL to 2006 in order to gather additional data to better determine the sources and extent of mercury contamination. ODEQ's schedule for the mercury TMDL coincides with this date.

The state of Oregon is developing capability to model site-specific bioaccumulation factors. This schedule change will allow a better use of these capabilities and the opportunity to collect additional data.

Both Idaho and Oregon have interim measures in place to deal with mercury contamination such as sediment controls and fish consumption advisories as described in Section 3.1. It is the opinion of the DEQs that this schedule change will not present an adverse impact to the SR-HC TMDL reach.

4.0.2 Nutrients/Dissolved Oxygen

A detailed discussion of sources, available data, associated water quality-related concerns and loading is available in Sections 2.2.4.1, 2.2.4.3, 2.3.1.2, 2.3.2.2, 2.3.3.2, and 3.2.

4.0.2.1 Loading

Nutrient concentrations are closely linked with dissolved oxygen and organic matter concentrations. Elevated concentrations of nutrients can lead to increased growth of algae and associated organic matter when other conditions such as water flow, depth, clarity, sunlight penetration, and temperature are conducive to enhanced growth. Algae and aquatic plants in turn consume oxygen from the water column during periods when respiration is the dominant process and in the aerobic decomposition of the dead algae and other detritus (non-living organic material). Total phosphorus has been identified as the nutrient of concern in the SR-HC TMDL reach. Improvements in dissolved oxygen can be achieved through attainment of growth-limiting concentrations of phosphorus (Section 3.2). Tables 4.0.5 and 4.0.6 contain calculated total phosphorus loading for point and nonpoint sources within the SR-HC TMDL reach.

Table 4.0.5. Total phosphorus waste loads from point sources in the Snake River - Hells Canyon TMDL reach for the critical time period based on 1995, 2000 data (May through September).

Point Source	NPDES Permit Number	Location (RM)	Current Design-Flow Load (kg/day)
City of Nyssa	101943 OR0022411	385	11
Amalgamated Sugar	101174 OR2002526	385	50
City of Fruitland	ID0020907	373	5.5
Heinz Frozen Foods	63810 OR0002402	370	412
City of Ontario	63631 OR0020621	369	0 [1]
City of Weiser (WWTP)	ID0020290	352	32
City of Weiser (WTP)	ID0001155	352	5.5 (max)
Brownlee Dam (IPCo)	ID0020907	285	Unmeasured assumed minimal[2]
Oxbow Dam (IPCo)	101275 OR0027286	272.5	Unmeasured assumed minimal[2]
Hells Canyon Dam (IPCo)	101287 OR0027278	247	Unmeasured assumed minimal[2]

1 City of Ontario uses land application in the summer months and does not currently contribute a phosphorus load to the SR-HC TMDL reach during the critical season.
2 Facilities sump discharge and turbine cooling water, not a phosphorus or waste treatment source.

Table 4.0.6. Calculated total phosphorus loading from tributary and nonpoint sources to the Snake River - Hells Canyon TMDL reach for the critical time period based on 1995, 1996 and 2000 data and average flow values (May through September).

Load Type	Location	Load (kg/day)	Estimation Method
Snake River Inflow	RM 409: Upstream Snake River Segment	1,912	See Section 3.2
Owyhee River	RM 396.7: Upstream Snake River Segment	265	See Section 3.2
Boise River	RM 396.4: Upstream Snake River Segment	1,114	See Section 3.2
Malheur River	RM 368.5: Upstream Snake River Segment	461	See Section 3.2
Payette River	RM 365.6: Upstream Snake River Segment	710	See Section 3.2
Weiser River	RM 351.6: Upstream Snake River Segment	392	See Section 3.2
Drains	Upstream Snake River segment (RM 409 to 335)	660	See Section 3.2
Ungaged flows	Upstream Snake River segment (RM 409 to 335)	385	See Section 3.2
Agriculture, Stormwater and Forestry	Upstream Snake River segment (RM 409 to 335)	Included in the ungaged flow loading	See Section 3.2
Burnt River	RM 327.5: Brownlee Reservoir Segment	52	See Section 3.2
Powder River	RM 296: Brownlee Reservoir Segment	126	See Section 3.2
Agriculture, Stormwater and Forestry	Brownlee Reservoir segment (RM 335 to 285)	Cannot be calculated due to reservoir “sink” effect, assumed small	See Section 3.2
Agriculture, Stormwater and Forestry	Oxbow Reservoir segment (RM 285 to 272.5)	Cannot be calculated due to reservoir “sink” effect, assumed small	See Section 3.2

The available data show that total phosphorus loading to the SR-HC reach originates almost entirely from the Upstream Snake River segment (RM 409 to 335). Measured total phosphorus loading to this segment accounts for the majority of the phosphorus load to the SR-HC reach, tributary loading equals 76 percent, point source loading represents approximately 8 percent, ungaged (estimated) drain flows accounting for 10 percent of the total system load and unmeasured sources accounting for approximately 6 percent of the total. Sources of unmeasured load may include nonpoint source runoff from anthropogenic sources and precipitation events, unidentified small tributaries and drains, error in gauged flow measurements and ground water sources.

Nutrient processing within the Hells Canyon Complex results in dramatic changes in measured total phosphorus concentrations downstream of Hells Canyon Dam as compared to those measured in the Upstream Snake River segment (RM 409 to 335). The change in phosphorus form and phosphorus sink characteristics of the reservoirs makes it impossible to determine loading from nonpoint sources within the immediate drainage area to the Hells Canyon Complex. The potential loading from these sources has been evaluated and assumed to be small as the incidence of recreational housing, agricultural practices (cropping and ranching) and municipal stormwater runoff is minimal, as is the intensity of use.

4.0.2.2 Load Capacity

Load capacity is calculated as the sum of the natural background load, point source loads and nonpoint source loads. In the tributary systems, the allocable load is equal to the load capacity, as outlined in the following equation.

Load Capacity = Allocated Tributary Load = Natural Background Load + Point Source Contribution + Nonpoint Source Contribution

The SR-HC TMDL reach load capacity for nutrients (Table 4.0.7) was determined by calculation using the target of 0.07 mg/L total phosphorus identified for the SR-HC TMDL, and average flow values (Table 2.1.1). These values represent total phosphorus loading capacity as identified for average flows. While these values are helpful in giving a relative understanding of the reductions required, and will apply reasonably over most water years, it should be noted that the absolute level of reduction required will depend on flow and concentration values specific to a given water year. The target shown to result in attainment of water quality standards and support of designated uses in the SR-HC TMDL reach is an instream concentration of less than or equal to 0.07 mg/L total phosphorus.

Table 4.0.7. Total phosphorus allocable load for segments in the Snake River - Hells Canyon TMDL reach based on the water column target concentration of 0.07 mg/L and calculated average flows (May through September).

Segment	Location	Load (kg/day)
Total Upstream Snake River segment	RM 409 to 335	2,735
Total Brownlee Reservoir segment *	RM 335 to 285	2,829
Total Oxbow Reservoir segment **	RM 285 to 272.5	2,839

*equal to the measured inputs of the upstream Snake River plus the Powder and Burnt Rivers, plus the estimated inputs of unmeasured tributaries (such as Brownlee Creek). Loads from unmeasured tributaries were estimated at 80 kg/day (approximately 2x the loading assessed for the Weiser Flat tributaries that discharge into the Snake immediately upstream of Brownlee Reservoir, most is projected to be delivered in the spring and summer seasons).
** equal to the measured inputs of Brownlee Reservoir, plus the estimated inputs of unmeasured tributaries (such as Wild Horse River). Loads from unmeasured tributaries were estimated at 20 kg/day (approximately 50% the loading assessed for the Weiser Flat tributaries that discharge into the Snake immediately upstream of Brownlee Reservoir, most is projected to be delivered in the spring and summer seasons). Load allocations to unmeasured tributaries were calculated at 50% reduction from estimated loads due to high probability for high natural loading.

Transport and deposition of phosphorus, and the resulting algal growth within the SR-HC TMDL reach is seasonal in nature. Transport and delivery of natural loading occurs primarily as a result of erosive forces during spring flows. Other natural sources of nutrient loading are discussed in Section 2.2.4.3. Transport and delivery of anthropogenic loading and the resulting algal growth occurs primarily during early summer to early fall. Therefore, the 0.07 mg/L total phosphorus target is seasonal in nature, extending from the beginning of May through the end of September. For the determination of allocable load for the five tributary streams to the Snake River, tributary specific data will be collected and reviewed as part of the implementation plan process. These data will allow for accurate, tributary-specific estimates of naturally occurring total phosphorus concentrations so that anthropogenic loads can be identified and allocated to point and nonpoint sources within the tributary systems. The sum of total phosphorus load and waste load allocations in each tributary will equal the load capacities listed in Table 4.0.7. These allocations will be identified on a tributary by tributary basis using tributary TMDL processes with the goal of establishing accurate site-specific targets for each anthropogenic source.

4.0.2.3 Margin of Safety

A 13 percent margin of safety has been applied to total phosphorus load allocations and capacity for this TMDL as determined by the accuracy and representativeness of sampling techniques and analytical methods. This margin of safety has been incorporated into the identification of the 0.07 mg/L total phosphorus target for the SR-HC TMDL. Other areas of uncertainty such as system uptake, assimilative capacity, and relative impairment to different use categories were addressed to the extent possible through the use of conservative assumptions in the identification of the nutrient target, sensitive designated uses and critical period.

4.0.2.4 Background/Natural Loading

For the mainstem Snake River portion of the SR-HC TMDL reach, the natural total phosphorus loading was calculated using the natural background concentration of 0.02 mg/L total phosphorus identified within the SR-HC TMDL, along with average flow values for the Snake River (Table 2.1.1). A necessary set of data for the tributary streams is not currently available. Therefore, natural background concentrations for all tributaries will be determined as part of upcoming TMDL development on the Weiser, Owyhee, and Malheur Rivers, and tributary implementation plans for the Payette and Boise Rivers.

4.0.2.5 Reserve

Waste load allocations to point sources were determined based on design capacity. The reserve capacity allocation is therefore the difference between the current discharge and design flow discharge. This allows for expansion of existing sources or addition of new point source discharges through trading or demonstration of an offset within the SR-HC system.

4.0.2.6 Total Phosphorus Load Allocations

Total Phosphorus load and waste load allocations have been identified for point and nonpoint sources in the SR-HC TMDL reach based on the less than 0.07 mg/L total phosphorus target and the seasonal application period (May through September).

Point Sources.

Biological nutrient removal (BNR) was identified as an appropriate mechanism for phosphorus removal for point sources currently employing activated sludge as a treatment process and discharging directly to the Snake River within the SR-HC TMDL reach. Application of this treatment reduction mechanism commonly results in an 80 percent reduction of total phosphorus concentration in the discharged effluent. As BNR represents a reasonable mechanism for the reduction of total phosphorus concentrations in point source discharges, and as the reductions commonly realized from BNR approximate the average reductions required from nonpoint sources (direct and tributary discharges to the Snake River) within the SR-HC TMDL reach, this mechanism was used as an initial basis for assigning total phosphorus waste load allocations for point sources discharging directly to the Snake River within the SR-HC TMDL reach (as outlined in Appendix I).

Table 4.0.8 contains waste load allocations for those permitted point sources that discharge directly to the Snake River within the SR-HC TMDL reach. Waste load allocations have been assigned to permitted point source discharges based on an evaluation of phosphorus reduction mechanisms available, the relative loading from each point source and type of treatment currently in place.

Waste load allocations to point sources discharging directly to the Snake River within the SR-HC TMDL reach have been assigned as follows:

- The critical time period over which total phosphorus reductions apply is from May through September.
- Point sources currently employing facultative lagoons (Table 4.0.8) represent a miniscule proportion of the total point source phosphorus loading (1.2%) within the SR-HC TMDL reach and will therefore not receive specific total phosphorus reduction requirements at this time. These facilities will prepare facilities plans to determine the costs and time frames associated with upgrading treatment mechanisms which will be used as the basis for future evaluation of potential phosphorus reductions.
- Point sources (activated sludge or other treatment method) (Table 4.0.8) represent a greater proportion of the total point source phosphorus loading (98.8%) within the SR-HC TMDL reach. These facilities will reduce total phosphorus loading by 80 percent (applied daily on a monthly average basis and based on design flows). While BNR was utilized as a basis for assigning appropriate point source load reductions, it is not required as a method of reduction under this TMDL. Any approved mechanism or treatment alternative (or combination of such) that results in the required daily 80 percent reduction (calculated on a monthly average basis) required will be acceptable under this TMDL (for example, land application during the target season would potentially be an acceptable method of achieving the total phosphorus reduction required if it were implemented in an approved and responsible fashion).
- The waste load allocations identified here for permitted point sources apply ONLY to those point sources discharging directly to the Snake River within the SR-HC TMDL reach. Waste load allocations to point sources discharging to tributaries that flow into the SR-HC TMDL reach will be the result of tributary TMDLs crafted through the state-specific tributary TMDL processes and will be completed on a state-specific basis and schedule.
- The current level of effort for total phosphorus reduction on the part of Amalgamated Sugar Company, and the identified goal of load minimization through stockpile removal are recognized in the waste load allocation identified in Table 4.0.8. Progress toward the identified goal will be documented through the iterative TMDL process and appropriate adjustments to the waste load allocation will be made if necessary.
- The current loading and thus the waste load allocations are based on limited effluent data. Waste load allocations for permitted point sources may be modified through the facility planning process if new information indicates that actual design loads were higher than originally determined.

Table 4.0.8. Total phosphorus waste load allocations (WLAs) for permitted point sources in the Snake River - Hells Canyon TMDL reach. (Waste load allocations are based on design flows and discharge concentrations from Table 2.5.0 for the critical period: May through September)**.**

Point Source	NPDES Permit Number	River Mile	Treatment Type	Total phosphorus Concentration (mg/L)	Current Design-Flow Load (kg/day)	Waste Load Allocation (kg/day)	% Reduction
City of Nyssa	101943 OR0022411	385	Activated sludge	3.5 mg/L[1]	11 kg/day	2.2 kg/day	80%
Amalgamated Sugar	101174 OR2002526	385	Seepage ponds	50 kg/day[2] (estimated)	50 kg/day	50 kg/day (initial) and continue with current reduction measures	
City of Fruitland	ID0020907	373	Facultative lagoon	2.9 mg/L	5.5 kg/day[3]	5.5 kg/day	0%
Heinz Frozen Foods	63810 OR0002402	370	Activated sludge	32 mg/L	412 kg/day	83 kg/day	80%
City of Ontario	63631 OR0020621	369	Facultative lagoon	3.5 mg/L[1]	0 kg/day [4]	0 kg/day	0%
City of Weiser (WWTP)	ID0020290	352	Activated sludge	3.5 mg/L[1]	32 kg/day	6.4 kg/day	80%
City of Weiser (WTP)	ID0001155	352	Settling pond	3.5 mg/L[1]	5.5 kg/day[3] (max)	5.5 kg/day	0%
Brownlee Dam (IPCo)	ID0020907	285		Assumed Negligible[5]	Unmeasured assumed minimal	Appropriate BMPs and source control	
Oxbow Dam (IPCo)	101275 OR0027286	272.5		Assumed Negligible[5]	Unmeasured assumed minimal	Appropriate BMPs and source control	
Hells Canyon Dam (IPCo)	101287 OR0027278	247		Assumed Negligible[5]	Unmeasured assumed minimal	Appropriate BMPs and source control	

1. Estimated value provided by Boise City Public Works for use in absence of monitored data.
2. Estimated value provided by Amalgamated Sugar for use in absence of monitored data.
3. Wastewater treatment systems utilizing lagoons will be required to prepare facilities plans showing potential treatment mechanisms to reduce phosphorus loading as part of any proposed upgrade or expansion of the facility.
4. City of Ontario uses land application in the summer months and does not currently contribute a phosphorus load to the SR-HC TMDL reach during the critical season.
5. Facilities sump discharge and turbine cooling water, not a phosphorus or waste treatment source.

Nonpoint Sources.

Table 4.0.9 lists the total phosphorus load allocations to nonpoint sources in the SR-HC TMDL reach.

Tributary inflows to the SR-HC TMDL reach have been treated as discrete, nonpoint sources for the purposes of loading analysis and allocation within this TMDL. Gross allocations have been

Table 4.0.9. Calculated total phosphorus load allocations for tributary, point and nonpoint sources to the Snake River - Hells Canyon TMDL reach based on calculated average flows (May through September).

Segment	Load Allocation[a,b] (kg/day)	Percent Reduction
Snake River Inflow	1,379	28
Owyhee River	71	73
Boise River	242	78
Malheur River	58	88
Payette River	469	34
Weiser River	136	65
Drains	91	86
Ungaged flows	137	64
Total Upstream Snake River Load Allocations	2582	54
Total Upstream Snake River Waste Load Allocations	153	
Total Upstream Snake River Segment Load and Waste Load Allocations	2,735[c]	
Burnt River	21	60
Powder River	33	74
Unmeasured Tributaries to Brownlee	40	50
Total Brownlee Reservoir Segment	2,829[d]	
Unmeasured Tributaries to Oxbow	10	50
Total Oxbow Reservoir Segment	2,839	

[a] The SR-HC TMDL target for total phosphorus for each tributary is a concentration of less than or equal to 0.07 mg/L total phosphorus as measured at the mouth of the tributary and applies from May through September. Because the total phosphorus target is concentration-based, actual allowable tributary load allocations under the TMDL are dependant on actual tributary flow and will fluctuate year to year. The total phosphorus load allocations listed in this table are based on averaged tributary flows measured in 1979, 1995 and 2000, which were average Snake River flow years, not necessarily average tributary flow years. Therefore they do not necessarily represent the calculated load allocations for any specific year or different series of years.

[b] Future data collection and analyses may determine that, due to natural conditions or other factors, the target concentrations for the mouths of the tributaries cannot be practicably achieved. This, in most cases, will occur when TMDLs are conducted on the tributaries. If subsequent tributary TMDLs indicate that the target concentration is not achievable, the Snake River/Hells Canyon TMDLs for total phosphorus will be reopened and appropriately revised.

[c] Total allocable load for this segment is 2,735 kg/day (2,582 kg/day from nonpoint sources and 153 kg/day from point sources)

[d] Total allocable load includes point source wasteload allocation from upstream sources. A dissolved oxygen load allocation has also been established for this segment.

assigned to each inflowing tributary equal to the load capacities listed in Table 4.0.7. Existing or future tributary TMDL processes will distribute load allocations in the form of load allocations and/or waste load allocations within their respective watersheds. Tributary loads are allocated to the mouth of the tributary and do not attempt to identify point and nonpoint source contributions within the tributary watersheds. Load allocations for tributaries are based on the less than or equal to 0.07 mg/L total phosphorus target and average flows (Table 2.1.1), and applies at the mouth of the tributary system. It is anticipated that tributary-specific data will be collected and will allow for accurate estimates of the naturally occurring total phosphorus loading so that anthropogenic loads can be identified and distributed to point and nonpoint sources within each tributary.

4.0.2.7 IMPLEMENTATION

The geographic scope of the SR-HC TMDL is extensive. The SR-HC watershed encompasses a 221 mile stretch of the Snake River with a 73,000 square mile drainage area. It is expected that attaining the SR-HC TMDL targets will require implementation of control strategies throughout this massive watershed, from facilities and return flows that discharge directly to the Snake River, to more remote activities affecting tributaries many miles upstream of their confluences with the Snake River.

Water users, administrative agencies, and research organizations in Idaho and Oregon have many years of experience developing and implementing strategies to improve water quality. Efforts in several tributary (e.g. Rock Creek) and upstream Snake River (e.g. the Middle Snake River) watersheds have become more focused during recent years as instream water quality objectives have been defined through TMDLs and other programs. These ongoing efforts provide incremental improvements to water quality as new treatments are applied to additional agricultural lands, storm drains, and point source discharges.

SR-HC PAT members and other PAT participants and consultants representing water users, administrative and research groups, together with the DEQs, utilized their collective experience to determine the time frame required to implement necessary control strategies throughout the SR-HC watershed to attain SR-HC TMDL targets. Due to the extraordinary size and complexity of the SR-HC watershed, its hydrology, and the various factors that affect the implementation of control strategies (discussed in Appendix I), it was determined that a time frame of approximately 50 to 70 years will be required to implement all necessary control strategies and fully attain SR-HC TMDL targets. This does not mean, however, that Snake River water quality will not improve until the TMDL targets are fully attained. For example, the DEQs have determined that there is a direct relationship between instream phosphorus concentrations and algal growth so that algal biomass will decrease incrementally as the instream concentration of phosphorus decreases. Water quality will consistently improve as treatments are applied to point and nonpoint discharges. To ensure measurable, consistent progress, interim, 10-year objectives (corresponding to 0.01 mg/l reductions in instream phosphorus concentrations) will be established. Progress in implementing control strategies will be reviewed periodically, and the time frame for full implementation can be evaluated in light of data and experience.

In identifying an appropriate time frame for implementation, the schedules of the tributary TMDLs and their Implementation Plans have to be considered. While there are some tributary TMDLs currently in place, others will not all be completed until the end of 2006. The tributary TMDLs must then be approved by EPA. The approval process can take several months. Implementation plans are completed approximately 18 months following EPA approval of TMDLs. For tributary TMDLs already in place this 18-month time frame starts with the approval of the SR-HC TMDL. For tributary TMDL processes that are not yet complete, the implementation plan will be prepared within 18 months of the approval of the tributary TMDL.

After completing an implementation plan, site-specific analyses must be performed to determine the most appropriate and effective control strategies for particular locations and land use activities. The time required for ground-level planning and project approval process varies widely depending upon the nature of the land and related hydrology, the land use, the parties involved, the type of treatment selected, and other factors.

Construction and implementation of management practices follows project approval. As with the planning and approval process, the time required to complete a project and realize water quality improvements varies from more the more immediate, as with introduction of rotational grazing as a management practice, to longer term, as with streambank re-vegetation and created wetlands (6 to 7 years may be necessary to establish vegetation that will produce adequate results).

In addition to the time required to achieve effective reductions, the time required for the river and reservoirs to fully respond to the improvement in inflowing water quality and process the existing pollutant loads already in place within the system must also be recognized. The occurrence of low water years or drought cycles can extend the instream response time by affecting the processing and transport of preexisting loads, just as high flows, which increase transport, and streambank erosion can affect instream response time.

In identifying what effect such an extended time frame for implementation would have on aquatic species that are currently at risk due to water quality concerns, it should be noted that generally the initial phases of implementation result in the most substantial reductions. Starting implementation as soon as possible, in a manner that will address the areas of greatest concern first and then work toward the areas of lower priority will allow substantial improvements in the water quality to occur in a shorter period of time than that described by the total implementation timeframe. While these initial improvements will most likely not result in meeting water quality targets all the time, everywhere, all at once, they will undoubtedly result in substantial, consistent improvement in water quality conditions throughout the reach.

As time and implementation progresses, the level of improvement will also increase until water quality targets are met. If dissolved oxygen concentrations in the areas of sturgeon habitat can be increased from near lethal levels to concentrations that are much closer to the target, then the support status will improve as well. This offers the potential for a positive outlook in the case of at-risk aquatic life such as the white sturgeon in the Upstream Snake River segment (RM 409 to 335). They will benefit from these initial improvements in habitat in many places, and from the improvement in water quality conditions overall.

4.0.2.8 Dissolved Oxygen Load Allocation

In addition to the total phosphorus load allocations for the Upstream Snake River segment (RM 409 to 335) and the tributaries, a dissolved oxygen load allocation has been established for Brownlee Reservoir (RM 335 to 285) (IPCo) to offset the calculated reduction in assimilative capacity due to the Hells Canyon Complex reservoirs.

The dissolved oxygen allocation requires the addition of 1,125 tons of oxygen (1.02 $x10^6$ kg) into the metalimnion and transition zone of Brownlee Reservoir (approximately 17.3 tons/day (15,727 kg/day)). The total dissolved oxygen mass required to address the loss of assimilative capacity in the metalimnion over this time frame is 1,053 tons (957,272 kg). This is equivalent to an even distribution of 16.2 tons/day (14,727 kg/day) over 65 days. The total dissolved oxygen mass required to address the loss of assimilative capacity in the transition zone over this time frame is 72 tons (65,454 kg). This is equivalent to an even distribution of 3.0 tons/day (2,727 kg/day) over 24 days.

The calculated time period when exceedences occurred in the metalimnion of Brownlee Reservoir is between Julian days 182 and 247 (the first of July through the first week of September) when dissolved oxygen sags are observed to occur to a greater degree than those identified as the result of poor water quality inflowing from the upstream sources. However, this time frame should not be interpreted as an absolute requirement. This approach recognizes that the actual mass of dissolved oxygen necessary per day is not static. It is variable depending on system dynamics and may vary from a few tons to as many as 30 tons per day. Timing of oxygen addition or other equivalent implementation measures should be such that it coincides with those periods where dissolved oxygen sags occur and where it will be the most effective in improving aquatic life habitat and support of designated beneficial uses. Water column dissolved oxygen monitoring is expected to be undertaken as part of this scheduling effort.

This load allocation does not require direct oxygenation of the metalimnetic and transition zone waters. It can be accomplished through equivalent reductions in total phosphorus or organic matter upstream, or other appropriate mechanism that can be shown to result in the required improvement of dissolved oxygen in the metalimnion and transition zones to the extent required. A reduction of 1.7 million kg of organic matter/algal biomass would equate to the identified dissolved oxygen mass. This translates to approximately 11,000 kg/day over the critical period (May through September) or 26,000 kg/day over the 65-day load period identified in the calculations for reduced assimilative capacity. Direct oxygenation can be used, but should not be interpreted as the only mechanism available. Cost effectiveness of both reservoir and upstream BMP implementation should be considered in all implementation projects.

Because there are both total phosphorus and dissolved oxygen load allocations assigned within different segments of the SR-HC TMDL reach, it must be clearly understood that Upstream Snake River segment (RM 409 to 335) pollutant sources are responsible for those water quality problems occurring in the Upstream Snake River segment. They are not responsible for those water quality problems that would occur if the waters flowing into Brownlee Reservoir met water quality standards and are exclusive to the reservoir. Similarly, IPCo (as operator of the Hells Canyon Complex) is responsible for those water quality problems related exclusively to impoundment effects that would occur if inflowing water met water quality standards.

Load allocations for the Upstream Snake River (RM 409 to 335) pollutant sources were identified to meet water quality standards in the Upstream Snake River segment and load allocations for Brownlee Reservoir (RM 335 to 285) were identified to address those water quality violations that would occur if the waters flowing into the Hells Canyon Complex met water quality standards.

It should not be interpreted from this load allocation scenario that the load allocations to Brownlee Reservoir (RM 335 to 285) do not have to be implemented until after all implementation has been completed upstream. All implementation (both that in the Upstream Snake River segment and that required from the Brownlee Reservoir segment) will be expected to proceed concurrently in a timely fashion following the approval of the SR-HC TMDL.

This TMDL will proceed toward completing site-specific implementation plans within 18 months of approval of the TMDL. Data collection will continue throughout the implementation process to determine progress and improve understanding of the SR-HC TMDL system. As this TMDL is a phased process, it is projected that the goals and objectives of this TMDL will be revisited periodically to evaluate new information and assure that the goals and milestones are consistent with the overall goal of meeting water quality standards in the SR-HC TMDL reach.

Monitoring of both point source discharge loads and instream water column concentrations will be undertaken as part of the implementation process. Instream monitoring will be identified in more detail in the site-specific implementation plans that will be completed 18 months following the approval of the SR-HC TMDL. It is expected that at minimum such monitoring will include the measurement of water column total phosphorus, chlorophyll *a*, and dissolved oxygen within each segment during time frames that represent high, low and average flow conditions. Measurement of sediment/water interface dissolved oxygen will also be accomplished in the Upstream Snake River segment (RM 409 to 335) during the first phase of implementation (5 year from approval of the SR-HC TMDL), or sooner.

4.0.2.9 TOTAL PHOSPHORUS LOAD AND WASTE LOAD ALLOCATION MECHANISMS.

As stated in Section 1.0, the overall goal of the SR-HC TMDL is to improve water quality in the SR-HC TMDL reach by reducing pollution loadings from all appropriate sources to restore full support of designated beneficial uses within the SR-HC TMDL reach. Two elements critical to achieving this goal are:

- To establish load allocation mechanisms that will allow attainment of the water quality targets through (to the extent possible) fair and equitable distribution of the identified pollutant loads, and result in productive implementation without causing undue hardship on any single pollutant source.
- To outline necessary implementation steps to attain the SR-HC TMDL pollutant targets. (This is accomplished in a general fashion in the water quality management plan (Oregon) and implementation plan (Idaho) submitted with this document, and in detail in the implementation plans to be completed within 18 months of US EPA TMDL approval).

Establishing long-term, scientifically supported water quality objectives, interim targets and load allocations based on feasible and attainable control strategies is consistent with the goal of the Clean Water Act and associated administrative rules for Oregon and Idaho that water quality standards shall be met or that all feasible steps will be taken towards achieving the highest quality water attainable. It is also consistent with the agencies' responsibility to provide reasonable assurance that TMDL objectives can be met.

With these principles in mind, members of the SR-HC PAT have worked together to develop a load allocation strategy for total phosphorus for point and nonpoint sources within the SR-HC TMDL reach. A complete copy of the strategy for point and nonpoint source dischargers is included in Appendix I.

This strategy seeks to establish interim targets and load allocations designed to reflect feasible control strategies and time frames within which those strategies can be implemented. These interim targets and load allocations were developed to recognize the various factors affecting the nature and extent of feasible and attainable BMP implementation.

As with the long-term targets and load allocations, periodic review will enable the DEQs and the stakeholders to adjust these interim targets and load allocations in accordance with information, analysis, and experience developed during the implementation of the SR-HC TMDL objectives.

The DEQs fully support and encourage stakeholder participation in this process and acknowledge the substantial progress that has been made on a multi-stakeholder front to develop an allocation mechanism for total phosphorus that will meet the requirements of the CWA and the TMDL process, while addressing the needs of the implementation participants.
The TMDL processes for both Oregon and Idaho require that water quality targets and the accompanying load allocation mechanisms will collectively result in attainment of water quality standards. Therefore, the goal of this total phosphorus TMDL for the SR-HC TMDL reach is to meet and sustain instream mainstem concentrations of 0.07 mg/L or less total phosphorus during the critical period of May through September. The framework of this approach is to meet TMDL targets and represents a valid process for implementation of the total phosphorus TMDL. As with any implementation process, progress on the ground and monitored water quality trends will be critical indicators as to whether this approach is successful in attaining the implementation goals identified.

Periodic review of additional data, level of implementation, system response and other pertinent factors will be carried out and necessary changes made. These changes may, among others, occur on the part of the TMDL, with better understanding of the system; on the part of the implementation process and the associated goals and interim milestones, and the part of the allocation mechanism discussed here.

Feasible pollution control strategies as those that can reasonably be taken by stakeholders to improve water quality within the physical, operational, economic and other constraints which affect their individual enterprises and their communities. Control strategies that will injure existing or future social and economic activity and growth are neither reasonable nor feasible. Attainable water quality goals are those that reflect control strategies that are feasible on a broad, watershed basis and recommended that highest cost management practices should not be the basis for water quality planning.

The SR-HC PAT members further identified several factors affecting BMP implementation for irrigated agriculture. As with irrigated agriculture, available funding is the primary constraint on BMP implementation for municipalities and other point sources. Most of the municipalities whose discharges affect the SR-HC reach are small communities with modest economies and tax bases. The principal factors affecting the implementation and effectiveness of BMPs for point sources are available funding, BMP costs, and the limits of currently available technology in reducing phosphorus in point source discharges. These factors are particularly important for small communities.

It is neither reasonable nor feasible to expect BMP implementation throughout the SR-HC TMDL watershed to achieve zero discharge, or widespread conversion to sprinkler irrigation, due to the extremely high costs and potential hydrologic impacts. Similarly, it is not reasonable to expect point sources to implement highest cost BMPs.

Nonpoint Source Load Allocation Mechanism

Attainable interim water quality goals for irrigated agriculture can be defined by identifying or estimating: (1) historically available private and public funding for water quality projects; (2) BMP costs; (3) pollutant reductions resulting from the installation of BMPs; (4) the status of BMP implementation within a watershed, community, or at a farm; and (5) the number of acres to be treated. Each of these factors was applied to an analysis of the Malheur, Boise, and Payette watersheds to project BMP implementation and resulting overall pollutant reductions over time from irrigation agriculture.

Assuming that historic annual funding for BMP implementation continues, and that funding doubles at least every 20 years to pay for replacement of equipment, so that all the identified priority acres are treated with $500.00 per acre treatment (representing feasible treatment strategies) to yield 68 percent overall reduction in the discharge of loads, the above analysis projects annual BMP implementation and corresponding reductions in total phosphorus loading from irrigated lands of 0.47 percent from the Payette watershed, 0.54 percent from the Boise watershed, and 0.97 percent from the Malheur watershed. The projected average annual total phosphorus reduction from irrigated lands in these watersheds is 0.66 percent. Since these three watersheds represent nearly 600,000 irrigated acres, and there are active, long-standing programs to implement BMPs in these watersheds, this rate of reduction can be used to project a rate of reduction throughout the SR-HC TMDL watersheds. At this rate of reduction, it would take 103 years to reach the maximum feasible 68 percent reduction of total phosphorus from irrigated lands in the SR-HC TMDL watersheds.

In order to compress the time frame for attainment of 68 percent total phosphorus reduction from irrigated lands, it will be assumed that federal and state funding levels increase to those currently available for BMP implementation in the Malheur River and Owyhee River watersheds. This will require doubling funding for the other watersheds, from $4.04 per acre annually in the Payette watershed and $4.66 per acre annually in the Boise watershed for all priority acres to the $8.43 per acre level that has been expended in the Malheur & Owyhee watersheds for all priority acres. This means that, for the Payette River and Boise River watersheds alone, federal and state programs and/or pollution trading must increase the annual non-farm investment in BMP implementation from $371,706 to $1,827,500. This increase is significant when annual state BMP funding, for the entire State of Idaho, has been approximately $1,500,000, and has recently been reduced to $1,400,000. It will also be assumed that funding doubles every 20 years to pay for replacement of equipment so that treatment of additional acres at the assumed rate of treatment may continue.

If this additional funding is made available, it is possible to project an annual total phosphorus reduction of 1 percent from irrigated lands in SR-HC TMDL watersheds, assuming the other factors affecting BMP implementation, cost, and performance do not impose their own constraints on BMP implementation. Applying an annual 1 percent total phosphorus reduction rate results in the following interim, ten-year load reduction objectives for the aggregate of irrigated lands in the Owyhee, Boise, Malheur, Payette, Weiser and Snake Rivers below RM 409.

Increased funding can affect the **rate** at which BMP implementation occurs (annually .66% vs. 1.0%) and the overall time it takes to attain 68 percent reductions from irrigated lands (103 years vs. 68 years). Currently, based on known techniques, technologies, BMP costs, hydrology, crop requirements, and the other factors that affect BMP implementation, it is not possible to project total phosphorus reductions from irrigated lands in the aggregate greater than 68 percent. Watershed-wide nonpoint source reductions greater than 68 percent will require currently unforeseeable changes in the factors affecting BMP implementation. This reduction rate together with projected reductions in point source loads and private industry participation in total phosphorus reduction through pollution trading is used to determine interim, ten-year targets and load allocations.

Annual 1% nonpoint source total phosphorus reductions

Current	10 (2014)	20 (2024)	30 (2034)	40 (2044)	50 (2054)	60 (2064)	68 (2064)
6,452 lbs/day	5,806(10%)	5,162(20%)	4,516(30%)	3,871(40%)	3,226 (50%)	2,581(60%)	2,065(68%)

Figure 4.0.1 Example interim load reduction goals based on 10-year objectives for irrigated agriculture. NOTE: The dates identified above are for illustration purposes only and are based on the assumption that the SR-HC TMDL will be approved in 2002, and that site-specific implementation plans will be completed by 2004. If the SR-HC TMDL is approved on a different time frame, the dates for the implementation process will follow the actual completion date of the site-specific implementation plans at 10-year increments.

Point Source Waste Load Allocation Mechanism

In correlation with the load allocation strategy for nonpoint sources above, a similar assessment was completed by members of the SR-HC PAT for point source discharges. The findings of this assessment are summarized below:

1. Based on recent Idaho experience, anticipated nonpoint source reductions could be 65 to 70 percent, however post treatment concentrations likely will be >100 ug/l where furrow irrigation is the primary irrigation practice.
2. Point Source controls occur in three technology steps. Cost increase rapidly after the first increment. Total phosphorus reduction costs range from $<5 to $2,600 lb/day and removal rates vary from 80 to 94 percent depending on technology used.
3. An allocation alternative evaluation is useful and provides critical information to the allocation process and decision makers. Allocation method has significant influence on basinwide TMDL implementation costs.

4. The members of the SR-HC PAT determined that, based on known techniques, point source controls beyond biological nutrient removal are neither feasible nor equitable.
5. Nutrient criteria or target determination methods have not been adopted be either Idaho or Oregon. Technical and regulatory approach to determine nutrient targets are rapidly evolving and likely will result in changes to the target during the implementation period anticipated for this TMDL, making adaptive management an important aspect of this TMDL.
6. Trading is a necessary tool in achieving cost effective implementation and should be an acceptable tool incorporated in the TMDL as an option in meeting allocations.

Preliminary, interim goals for total phosphorus reduction (cumulative point and nonpoint source activities) have been identified as part of this load allocation process. They include a reduction goal for total phosphorus concentration of 0.01 mg/L every 10 years. It is expected that this preliminary schedule will encourage the identification of implementation priorities that will result in consistent reduction activities. It is also expected that these preliminary goals will be refined as site-specific implementation plans are finalized and information on reduction efficiency is collected.

4.0.3 Pesticides

A detailed discussion of sources, available data, associated water quality-related concerns and loading is available in Sections 2.3.3.2, and 3.3.

4.0.3.1 LOADING

As the pesticides of concern (DDT and dieldrin) are no longer in use (both are banned pesticides), the existing loading is assumed to occur solely from legacy application or contamination. Anthropogenic sources are confined to runoff from areas that have been treated historically and areas where storage or spillage occurred historically. Current practices make municipal or stormwater sources from urban areas very unlikely to be significant loading sources. Point source loading is considered negligible. Pesticide concentrations in treated effluent occur as the result of concentrations in incoming source water rather than as an artifact of the treatment process.

No pesticide data are available for the Oxbow Reservoir segment (RM 285 to 272.5). The data set available for the Upstream Snake River and Brownlee Reservoir segments (RM 409 to 285) were used to provide a rough approximation of pesticide loading to the SR-HC TMDL reach. Loading at the USGS gage at Weiser (mainstem Snake River) was calculated to be approximately 42 kg/year t-DDT and 28 kg/year dieldrin for an average water year. Assuming that the data collected were representative of the average annual concentrations in the water column, this shows that the current pesticide loading is between 30 and 100 times greater in the Upstream Snake River segment (RM 409 to 335) of the SR-HC reach than the targets would allow.

4.0.3.2 LOAD CAPACITY

The SR-HC TMDL reach load capacity for t-DDT and dieldrin (Table 4.0.10) was determined by calculation using the target of 0.024 ng/L DDT water column concentration and the 0.07 ng/L dieldrin water column concentration identified for the SR-HC TMDL, and average flow values (calculated from 1979, 1995 and 2000 flow data). Water column data was available for the Upstream Snake River segment (RM 409 to 335) only.

Table 4.0.10. t-DDT and dieldrin (pesticide) load capacity for segments in the Snake River - Hells Canyon TMDL reach based on the water column target concentrations of 0.024 ng/L (DDT) and 0.07 ng/L (dieldrin) and calculated average flows.

Segment	Annual Load Capacity t-DDT (kg/year)	Annual Load Capacity Dieldrin (kg/year)
Upstream Snake River Segment (RM 409 to 335)	0.34	0.98
Brownlee Reservoir Segment (RM 335 to 285)	0.37	1.1
Oxbow Reservoir Segment (RM 285 to 272.5)	0.37	1.1

4.0.3.3 Margin of Safety

An explicit margin of safety of 10 percent has been used in calculation of the load allocation. An implicit margin of safety is also present, based on conservative values identified for the assimilative capacity. Other areas of uncertainty such as bioconcentration capacity and relative threat to different use categories are accounted for to the extent possible in the identification of the target concentrations as a conservative value.

4.0.3.4 Background/Natural Loading

There is no natural DDT or dieldrin loading.

4.0.3.5 Reserve

Due to the fact that these are banned pesticides, no reserve capacity was established for DDT or dieldrin.

4.0.3.6 Load Allocations

Table 4.0.11 lists the load allocations for DDT and dieldrin on a general basis for the Upstream Snake River segment (RM 409 to 335). Insufficient data are available to further differentiate pollutant sources within the segment. These load allocations represent the sum of point and nonpoint source-related loading to the SR-HC TMDL reach, and therefore to the Oxbow Reservoir segment (RM 285 to 272.5), the only segment in the SR-HC TMDL reach that is listed for pesticides.

Due to the lack of data necessary to accurately characterize pesticide loading to the Oxbow Reservoir segment (RM 285 to 272.5), and the diffuse and widespread legacy nature of pesticide loading to the Snake River; a watershed-based approach will be employed wherein reductions in pesticide loading will be accomplished through best management practices for sediment control. This reduction strategy will be implemented in direct correlation with other reduction efforts identified by this TMDL and concurrent efforts already underway in the SR-HC drainage. In the SR-HC TMDL, sediment (total suspended solids, TSS) targets and monitored trends will function as an indicator of changes in transport and delivery for these attached pollutants.

Table 4.0.11. Identified load allocations for the reduction of pesticides in the Snake River - Hells Canyon TMDL reach.

Segment	Load Allocation for t-DDT (kg/year)	Load Allocation for Dieldrin (kg/year)
Load allocation specific to legacy applications		
Upstream Snake River Segment (RM 409 to 335)	0.31	0.88
Brownlee Reservoir Segment (RM 335 to 285)	0.33	1.0
Oxbow Reservoir Segment (RM 285 to 272.5)	0.33	1.0
Load allocation specific to current application		
Upstream Snake River Segment (RM 409 to 335)	0	0
Brownlee Reservoir Segment (RM 335 to 285)	0	0
Oxbow Reservoir Segment (RM 285 to 272.5)	0	0

In this manner, diffuse legacy sources will be effectively addressed by best management practices that will improve water quality for a number of listed constituents simultaneously (i.e. mercury, pesticides, sediment and nutrients). Load allocations for pesticides do not vary seasonally and will be applied year-round. Critical conditions, when the majority of transport is projected to occur, are April through October, encompassing the spring runoff and summer irrigation seasons.

NOTE: The load allocations identified do not require monitoring of pesticide loading or load reductions. Such monitoring is not considered feasible and will therefore not be required as part of this TMDL process. Rather, appropriate management techniques specific to responsible stewardship will be employed as part of the TMDL implementation process. These management techniques are projected to result in reduction of overall DDT and dieldrin loading related to nonpoint source discharge to the mainstem Snake River.

Available data do not yield a clear answer on the support status of designated beneficial uses but indicate that sufficient concern exists to justify the collection of additional water column data in both the Oxbow Reservoir segment (RM 285 to 272.5) and the segments upstream.

4.0.4 pH and Bacteria

A detailed discussion of sources, available data, associated water quality-related concerns and loading is available in Sections 2.2.4.4, 2.3.1.2, and 3.4.

4.0.4.1 LOADING

Based on the available data, the SR-HC TMDL process recommends that the mainstem Snake River (RM 409 to RM 347, OR/ID border to Scott Creek inflow) be delisted for bacteria by the State of Idaho as part of the first 303(d) list submitted by the State of Idaho subsequent to the approval of the SR-HC TMDL. The SR-HC TMDL process further recommends that monitoring of bacteria levels (*E. coli*), especially in those areas of the SR-HC TMDL reach where recreational use consistently occurs, continue to be an integral part of the water quality monitoring of the Upstream Snake River segment (RM 409 to 335).

Based on the available data, the SR-HC TMDL process recommends that the mainstem Snake River from RM 409 to RM 347 (OR/ID border to Scott Creek inflow) and from RM 335 to RM 285 (Brownlee Reservoir) be delisted for pH by the State of Idaho as part of the first 303(d) list submitted by the State of Idaho subsequent approval of the SR-HC TMDL. The SR-HC TMDL process further recommends that monitoring of pH continue to be an integral part of the water quality monitoring of the Upstream Snake River segment (RM 409 to 335).

4.0.4.2 Load Allocations

The data showed no exceedences of water quality targets for the SR-HC TMDL reach. Delisting of these two pollutants is recommended; therefore no load allocations have been identified.

4.0.5 Sediment

A detailed discussion of sources, available data, associated water quality-related concerns and loading is available in Sections 2.2.4.5, 2.3.1.2, 2.3.2.2, 2.3.3.2, and 3.5.

4.0.5.1 Loading

The Upstream Snake River (RM 409 to 335), Brownlee Reservoir (RM 335 to 285) and Oxbow Reservoir segment (RM 285 to 272.5) of the SR-HC TMDL are listed for impairment due to sediment. No duration data is available to assess the extent of impairment or support in these reaches. During the first phase of implementation (the five years following the approval of the SR-HC TMDL) duration data will be collected to determine if designated aquatic life uses are being impaired. Targets have been set in a conservative fashion so that aquatic life uses will be protected in the listed segments.

Sediment loading within the SR-HC TMDL reach is also of concern because of the attached pollutant loads (mercury, pesticides and nutrients) that the sediment carries. In the SR-HC TMDL, sediment (total suspended solids (TSS)) targets and monitored trends will function as indicators of changes in the transport and delivery of these attached pollutants.

The available data show that sediment loading into the SR-HC reach originates almost exclusively from the Upstream Snake River segment (over 95%). Sources of unmeasured load may include nonpoint source runoff from anthropogenic sources and precipitation events, unidentified small tributaries and drains, error in gauged flow measurements and ground-water sources.

Tables 4.0.12 and 4.0.13 contain calculated total suspended solids loads for point and nonpoint sources in the SR-HC TMDL reach.

Sediment deposition and processing within the Hells Canyon Complex reservoirs results in dramatic changes to the measured total suspended solids concentration as compared to upstream concentrations. This change makes it impossible to determine loading from nonpoint sources within the immediate drainage area to the Hells Canyon Complex. The potential loading from these sources has been evaluated and assumed to be small as the incidence of agricultural

Table 4.0.12. Sediment (TSS) loads from point sources in the Snake River - Hells Canyon TMDL reach based on 1995, 2000 data.

Point Source	NPDES Permit Number	Location (RM)	Current Design-Flow Load (kg/day)
City of Nyssa	101943 OR0022411	385	32 kg/day
Amalgamated Sugar	101174 OR2002526	385	Negligible
City of Fruitland	ID0020907	373	62 kg/day
Heinz Frozen Foods	63810 OR0002402	370	396 kg/day
City of Ontario	63631 OR0020621	369	209 kg/day
City of Weiser (WWTP)	ID0020290	352	213 kg/day
City of Weiser (WTP)	ID0001155	352	Negligible
Brownlee Dam (IPCo)	ID0020907	285	Negligible
Oxbow Dam (IPCo)	101275 OR0027286	272.5	Negligible
Hells Canyon Dam (IPCo)	101287 OR0027278	247	Negligible

practices (cropping and ranching) and municipal stormwater runoff is minimal, as is the intensity of use.

4.0.5.2 Load Capacity

The SR-HC TMDL reach load capacity for total suspended solids was determined by calculation using the target of 50 mg/L monthly average water column concentration identified for the SR-HC TMDL, and average flow values (Table 2.1.1), as shown in Table 4.0.14.

Transport and deposition of sediments into and within the SR-HC TMDL reach is seasonal in nature. Erosion of natural sources and transport of anthropogenic sources occurs primarily during spring and summer flows.

4.0.5.3 Margin of Safety

An implicit margin of safety is incorporated into the SR-HC TMDL sediment targets, as all parameters used to identify these targets were conservative in nature. An additional explicit margin of safety of 10 percent has been used in calculation of the load allocations.

4.0.5.4 BACKGROUND/NATURAL LOADING

As there are no undeveloped watersheds in the SR-HC TMDL reach to use as a reference system for determining natural loading, an estimate was derived using the data available for spring runoff in the SR-HC TMDL reach as described in Section 3.5.3.1. The average relative natural sediment loading delivered was calculated at 24 percent of the total suspended solids loading for the mainstem Snake River and represents a conservative estimate.

A necessary set of data for the tributary streams is not currently available. Therefore, natural background concentrations for all tributaries will be determined as part of upcoming TMDL development on the Weiser, Owyhee, and Malheur Rivers, and tributary implementation plans for the Payette and Boise Rivers.

Table 4.0.13. Sediment (TSS) loads from nonpoint sources in the Snake River - Hells Canyon TMDL reach for 1995, 1996 and 2000 data and average flow values.

Load Type	Location	Load (kg/day)	Estimation Method
Snake River Inflow	RM 409: Upstream Snake River Segment	677,785	See Section 3.5
Owyhee River	RM 396.7: Upstream Snake River Segment	66,152	See Section 3.5
Boise River	RM 396.4: Upstream Snake River Segment	130,466	See Section 3.5
Malheur River	RM 368.5: Upstream Snake River Segment	92,870	See Section 3.5
Payette River	RM 365.6: Upstream Snake River Segment	137,887	See Section 3.5
Weiser River	RM 351.6: Upstream Snake River Segment	53,617	See Section 3.5
Drains	Upstream Snake River segment (RM 409 to 335)	143,430	See Section 3.5
Ungaged flows	Upstream Snake River segment (RM 409 to 335)	181,484	See Section 3.5
Agriculture, Stormwater and Forestry	Upstream Snake River segment (RM 409 to 335)	Included in the ungaged flow loading	See Section 3.5
Upstream Snake River Segment Total Loading	RM 409 to 335	1,483,691	See Section 3.5
Burnt River	RM 296: Brownlee Reservoir Segment	13,274	See Section 3.5
Powder River	RM 327.5: Brownlee Reservoir Segment	14,857	See Section 3.5
Agriculture, Stormwater and Forestry	Brownlee Reservoir segment (RM 335 to 285)	Cannot be calculated, assumed small	See Section 3.5
Agriculture, Stormwater and Forestry	Oxbow Reservoir segment (RM 285 to 272.5)	Cannot be calculated, assumed small	See Section 3.5

4.0.5.5 RESERVE

Waste load allocations to point sources were determined based on design capacity. The reserve capacity allocation is therefore the difference between the current discharge and design flow discharge. This allows for expansion of existing sources or addition of new point sources discharge through trading or demonstration of an offset within the SR-HC system.

4.0.5.6 LOAD ALLOCATIONS

Table 4.0.15 a and b identify the load and waste load allocations for point and nonpoint sources in the SR-HC TMDL reach. Point source discharges represent less than 0.04 percent of the total load capacity for the SR-HC TMDL reach. Many point sources employ treatment measures that dramatically reduce the sediment concentrations in their effluent as compared to the source water. Due to the fact that point source loading represents such a miniscule proportion of the total load, waste load allocations have been established at existing NPDES permit levels for all point sources discharging directly to the mainstem Snake River. In cases where existing NPDES permits do not identify limits for total suspended solids (or an appropriate equivalent measure), limits will be established at no greater than 50 mg/L applied on a monthly average. Quantitative load allocations in kg per unit of time can be calculated from Table 4.0.15 a by multiplying the existing permit limits by the design flows identified in Table 2.0.5.

Table 4.0.14. Sediment (TSS) load capacity for segments in the Snake River - Hells Canyon TMDL reach based on the water column target concentration of 50 mg/L (monthly average), current discharge concentrations and calculated average flows.

Segment	Location	Load (kg/day)
Snake River Inflow	RM 409: Upstream Snake River Segment	1,171,626
Owyhee River	RM 396.7: Upstream Snake River Segment	53,341
Boise River	RM 396.4: Upstream Snake River Segment	165,077
Malheur River	RM 368.5: Upstream Snake River Segment	46,735
Payette River	RM 365.6: Upstream Snake River Segment	329,478
Weiser River	RM 351.6: Upstream Snake River Segment	134,604
Drains	Upstream Snake River segment (RM 409 to 335)	64,031
Ungaged flows	Upstream Snake River segment (RM 409 to 335)	131,309
Total Upstream Snake River Segment	RM 409 to 335	2,096,201
Burnt River	RM 296: Brownlee Reservoir Segment	10,792
Powder River	RM 327.5: Brownlee Reservoir Segment	29,276
Total Brownlee Reservoir Segment	RM 335 to 285	2,098,835
Total Oxbow Reservoir Segment	RM 285 to 272.5	2,116,038

If monitored trends indicate that sediment concentrations are increasing, despite implementation efforts, new, more conservative targets will be considered and load allocations will be revised. If monitored trends indicate that sediment concentrations are decreasing in correlation with implementation efforts, an associated decrease in attached pollutants will be assumed to occur and load allocations will not be reduced.

In the meantime, while duration data is being collected, the targets will function as a loading “cap” in the listed segments, representing a reasonable assurance that aquatic life uses are being protected until a more accurate of designated use support can be made.

This allocation mechanism does not place additional restrictions on those sources already at or below target concentrations. Due to the nature of most nutrient reduction BMPs, total suspended solids loading is expected to decrease with implementation for total phosphorus load allocations. These two processes are highly correlated and implementation is projected to occur in a complimentary fashion

This TMDL will proceed toward completing site-specific implementation plans within 18 months of approval of the TMDL. Data collection for duration information is projected to be accomplished within the first five years following the approval of the TMDL. Additional data gathering will throughout the implementation process to determine progress and improve

Table 4.0.15 a. Total suspended solids (TSS) waste load allocations for point sources discharging directly to the Snake River - Hells Canyon TMDL reach (RM 409 to 188).

Point Source	NPDES Permit Number	Location (RM)	Load Allocation (no greater than)
City of Nyssa	101943 OR0022411	385	30 mg/L (monthly average)
Amalgamated Sugar	101174 OR2002526	385	4,924 lbs/day (monthly average)
City of Fruitland	ID0020907	373	70 mg/L (monthly average)
Heinz Frozen Foods	63810 OR0002402	370	4,200 lbs/day (monthly average)
City of Ontario	63631 OR0020621	369	85 mg/L (monthly average)
City of Weiser (WWTP)	ID0020290	352	400 mg/L (daily average)
City of Weiser (WTP)	ID0001155	352	50 mg/L (monthly average)
Brownlee Dam (IPCo)	ID0020907	285	50 mg/L (monthly average)
Oxbow Dam (IPCo)	101275 OR0027286	272.5	50 mg/L (monthly average)
Hells Canyon Dam (IPCo)	101287 OR0027278	247	0.25 lbs/day (monthly average)

understanding of the SR-HC TMDL system. As this TMDL is a phased process, it is projected that the goals and objectives of this TMDL will be revisited periodically to evaluate new information and assure that the goals and milestones are consistent with the overall goal of meeting water quality standards in the SR-HC TMDL reach.

Monitoring of both point source discharge loads and instream water column concentrations will be undertaken as part of the implementation process. Instream monitoring will be identified in more detail in the site-specific implementation plans that will be completed 18 months following the approval of the SR-HC TMDL. However, it is expected that at minimum such monitoring

Table 4.0.15 b. Total suspended solids (TSS) load allocations (shown in bold type), sediment thresholds and percent reductions required for nonpoint sources within the Snake River - Hells Canyon TMDL reach (RM 409 to 188).

Source	Location (RM)	Calculated Load (kg/day)	Load Allocations [a] (kg/day)	Loading Capacity (kg/day)	% Reduction Required
Snake River Inflow	RM 409: Upstream Snake River Segment	677,785	677,785		0%
Owyhee River	RM 396.7: Upstream Snake River Segment	66,152	**48,007**		27%
Boise River	RM 396.4: Upstream Snake River Segment	130,466	130,466		0%
Malheur River	RM 368.5: Upstream Snake River Segment	92,870	**42,062**		55%
Payette River	RM 365.6: Upstream Snake River Segment	137,887	137,887		0%
Weiser River	RM 351.6: Upstream Snake River Segment	53,617	53,617		0%
Drains	Upstream Snake River segment (RM 409 to 335)	143,430	**57,628**		60%
Ungaged flows	Upstream Snake River segment (RM 409 to 335)	181,484	**118,178**		35%
Total Upstream Snake River Segment	RM 409 to 335	1,483,691		1,265,630	15% [c]
Burnt River	RM 296: Brownlee Reservoir Segment	13,274	**9,713**		27%
Powder River	RM 327.5: Brownlee Reservoir Segment	14,857	14,857		0%
Total Brownlee Reservoir Segment	RM 335 to 285	n/a [b]		1,290,200	
Total Oxbow Reservoir Segment	RM 285 to 272.5	n/a [b]		1,305,682	

[a] Load allocations (shown in bold type) are based on calculated load capacities, less a 10% margin of safety. In those cases where measured sediment concentrations were not observed to exceed the target values, no reductions are required. However, in an effort to prevent further degradation within the SR-HC TMDL reach, threshold values have been established at the current sediment loads. These thresholds will be recognized in considering future management options, and will act to direct future decisions to those options that will not result in an increase in sediment loading from these tributaries to the SR-HC TMDL reach.

[b] The sediment loading to these reaches cannot be accurately calculated due to the sink effect of the reservoirs. Thresholds have been determined using load capacity determinations and upstream loading calculations.

[c] The % reduction listed is representative of the reduction in total loading to the identified segment as a result of required reductions in loading realized upstream.

will include the measurement of duration-based water column total suspended solids within each segment during time frames that represent high, low and average flow conditions.

Load allocations and reductions identified in Tables 4.0.15 a and b, and Table 3.5.6 are specific to those tributaries discharging at total suspended solids concentrations greater than 50 mg/L monthly average. These reductions are expected to minimize the potential for site specific degradation of habitat and impairment of designated uses at the inflow point within the mainstem Snake River.

The majority of treatment mechanisms to reduce total phosphorus also offer sediment reduction benefits. Therefore, it is anticipated that implementation measures for sediment and total phosphorus reduction will be mutually beneficial. Full implementation for attainment of total phosphorus targets (Section 3.2) is expected to result in attainment of sediment targets in many cases.

4.0.6 Temperature

A detailed discussion of sources, available data, associated water quality-related concerns and loading is available in Sections 2.2.4.6, 2.3.1.2, 2.3.2.2, 2.3.3.2, 2.3.4.2, 2.3.5.2 and 3.6.

4.0.6.1 Loading

The assumptions utilized in the loading assessment for this TMDL were applied for the purpose of calculating the potential impact of tributary loading on main stem temperatures. These assumptions have not been verified and thus, may not reflect the actual conditions present in the tributaries. In addition, this TMDL does not address temperature reductions that may be required in the tributaries themselves to meet water quality standards in the tributaries. Those will be assessed through the tributary TMDL process.

Load and waste load allocations identified are based on the attainment of water quality targets for salmonid rearing/cold water aquatic life and salmonid spawning as outlined below.

4.0.6.2 Salmonid Rearing/Cold Water Aquatic Life Beneficial Uses

The temperature target identified for the protection of salmonid rearing/cold water aquatic life when aquatic species listed under the Endangered Species Act are not present or, if present, a temperature increase would not impair the biological integrity of the Threatened and Endangered population, is: 17.8 ^{o}C (expressed in terms of a 7-day average of the maximum temperature) if and when the site potential is less than 17.8 ^{o}C. If and when the site potential is greater than 17.8 ^{o}C, the target is no more than a 0.14 ^{o}C increase from anthropogenic sources.

When aquatic species listed under the Endangered Species Act are present and if a temperature increase would impair the biological integrity of the Threatened and Endangered population then the target is no greater than 0.14 ^{o}C increase from anthropogenic sources.

The salmonid rearing/cold water aquatic life temperature target identified for the SR-HC TMDL reach applies to RM 409 to 188. This target applies year-round; the critical time period (as defined by elevated water temperatures) is from June through September.

Although it is observed that water temperatures throughout the SR-HC TMDL reach exceed the water quality targets for salmonid rearing/cold water aquatic life during the critical time period (June through September) the analysis of temperature sources undertaken as part of this TMDL has demonstrated that natural atmospheric and non-quantifiable influences preclude the attainment of these targets rather than quantifiable anthropogenic influences. Available data on fish species and temporal/spatial distribution within the Hells Canyon Complex of reservoirs indicates that the designated salmonid rearing/cold water aquatic life use is supported through the availability of cold water refugia. Such refugia does not appear to exist in the Upstream Snake River segment (RM 409 to 335) of this TMDL at the same level as in the reservoir systems.

Modeling work completed by IPCo (IPCo, 2002b) has shown that if the water inflowing to Brownlee Reservoir at RM 335 were at or below numeric temperature targets for salmonid rearing/cold water aquatic life, water leaving the Hells Canyon Complex at Hells Canyon Dam would also be at or below numeric temperature targets for salmonid rearing/cold water aquatic life, regardless of the temperature shift specific to the Hells Canyon Complex. This modeling shows that the Hells Canyon Complex is not the source of the heat load in the reservoirs during the summer season. Therefore, it is concluded that the Hells Canyon Complex is not contributing to temperature exceedences specific to the to salmonid rearing/cold water aquatic life designated use and no requirement for temperature adjustment, specific to salmonid rearing/cold water aquatic life use has been identified for the Hells Canyon Complex dams.

Point Sources.

Waste load allocations specific to temperature for this TMDL will limit point sources to existing loads based on design flow. Currently, cumulative, calculated anthropogenic increases in temperature do not occur above the defined “no-measurable-increase” value of 0.14 ^{o}C. Therefore, the focus of this TMDL is to ensure that additional, anthropogenic temperature influences do not occur over the defined no-measurable-increase value, to protect the cold water refugia currently in place within the SR-HC TMDL reach, and to improve water temperatures in a site-specific fashion in the Upstream Snake River segment (RM 409 to 335) where cold water refugia may be restored. Table 4.0.16 outlines general waste load allocations.

These allocations are calculated on estimated average daily discharge temperatures and design flows. Point source waste load allocations were calculated using the following equation:

WLA = (Discharge Quantity (design flow), # water/day) x (Pt. Source Average Daily Temperature, ^{o}F)

A waste load allocation for future point sources of no measurable increase has been identified as part of this TMDL.

Specific actions identified to accomplish these goals are as follows:

- Point source allocations will be set at current discharge levels.
- Specific temperature effluent limitations in NPDES permits for permitted point sources as listed in Table 3.6.8 will be determined using additional data collection and analysis provided through the facilities plan required of each point source.

- In addition to meeting specified waste load allocations, point source permits will also be expected to address any potential, near field (or mixing zone) water quality issues.

Table 4.0.16. Permitted point source discharge temperature waste load allocations specific to cold water aquatic life/salmonid rearing for the Snake River - Hells Canyon TMDL reach (RM 409 to 188).

Point Source	Point Source Average Daily Temperature (^{o}F)	Discharge Volume (design flow)	Allocated Heat Load in Million BTU/day
City of Nyssa	72*	0.8 MGD	480
Amalgamated Sugar		Seepage ponds	NA
City of Fruitland	72*	0.5 MGD	300
Heinz Frozen Foods	32 ^{o}C (90 ^{o}F)*	3.4 MGD	2,557
City of Ontario	72*	Land Application	NA
City of Weiser	72*	2.4 MGD	1,440
Brownlee Dam	76**	15 MGD	9,500
Oxbow Dam	76**	11 MGD	6,880
Hells Canyon Dam	76**	9 MGD	4,750

* Estimated values.
** Existing permit effluent limits.

These allocations are specific to the salmonid rearing/coldwater aquatic life target, which applies year-round. The critical period for this target in the SR-HC TMDL reach (that time period in which target exceedences are most likely to occur) is from May through September. During the non-critical period, NPDES permits shall ensure that discharges are limited to ensure that each source does not violate water quality standards.

These findings and requirements will be periodically reviewed as additional data and information become available to ensure that the assumptions made and the goals identified remain consistent with full support of designated beneficial uses.

More precise data will be collected and analyzed as part of the facility planning process discussed in the Water Quality Management Plan included with the TMDL. Actual effluent limitations will be derived from the facility plan data.

Also, it must be recognized that the temperature TMDL and associated load allocations are intended to address far field or accumulative impacts from point sources. Permits must also address near field impacts to ensure that appropriate standards are not violated either outside or inside the regulatory mixing zone.

Nonpoint Sources.

Table 4.0.17 lists load allocations specific to cold water aquatic life/salmonid rearing designated beneficial uses.

A gross nonpoint source temperature load allocation has been established as a total anthropogenic loading of less than 0.14 ^{o}C. (This load allocation applies primarily to agricultural and stormwater drains and similar inflows.) This allocation applies at discharge to the Snake

River in the SR-HC TMDL reach, during those periods of time that the site potential temperature in the mainstem Snake River is greater than 17.8 ^{o}C. It is projected that implementation associated with total phosphorus and suspended solids reduction will result in reduced inflow temperatures in the smaller drains and tributaries to the mainstem Snake River as many of the approved methods for the reduction of total phosphorus and suspended solids are based on streambank re-vegetation and similar methodologies that will increase shading.

Table 4.0.17. Nonpoint source temperature load allocations specific to cold water aquatic life/salmonid rearing for the Snake River - Hells Canyon TMDL reach (RM 409 to 188). Applicable when water temperatures are in excess of 17.8 ^{o}C.

Segment	Nonpoint Source Load Allocation
Nonpoint sources discharging directly to the Snake River in the SR-HC TMDL reach	
SR-HC TMDL Reach	total anthropogenic loading less than 0.14 ^{o}C at RM 409 during that period of time that the site potential of the mainstem Snake River is above 17.8 ^{o}C due to natural or non-quantifiable temperature sources.
Associated actions: assessment of impacts to anthropogenic loading as part of management changes	
Tributary sources discharging directly to the Snake River in the SR-HC TMDL reach	
Upstream Snake River (RM 409 to 335)	total anthropogenic loading less than 0.14 ^{o}C at RM 409 during that period of time that the site potential of the mainstem Snake River is above 17.8 ^{o}C due to natural or non-quantifiable temperature sources.
Brownlee Reservoir (RM 335 to 285)	total anthropogenic loading less than 0.14 ^{o}C at RM 409 during that period of time that the site potential of the mainstem Snake River is above 17.8 ^{o}C due to natural or non-quantifiable temperature sources.
Oxbow Reservoir (RM 285 to 272.5)	total anthropogenic loading less than 0.14 ^{o}C at RM 409 during that period of time that the site potential of the mainstem Snake River is above 17.8 ^{o}C due to natural or non-quantifiable temperature sources.
Hells Canyon Reservoir (RM 272.5 to 247)	total anthropogenic loading less than 0.14 ^{o}C at RM 409 during that period of time that the site potential of the mainstem Snake River is above 17.8 ^{o}C due to natural or non-quantifiable temperature sources.
Downstream Snake River (RM 247 to 188)	total anthropogenic loading less than 0.14 ^{o}C at RM 409 during that period of time that the site potential of the mainstem Snake River is above 17.8 ^{o}C due to natural or non-quantifiable temperature sources.
Associated actions: assessment of anthropogenic loading at the mouth as part of the tributary TMDL process	

* Direct monitoring of anthropogenic temperature increases is not feasible for these sources and therefore will not be required as part of this TMDL process. Rather, appropriate management techniques specific to proper stewardship will be employed as part of the overall TMDL implementation process. These management techniques are projected to result in reduction of overall anthropogenic temperature increases related to nonpoint source discharge to the mainstem Snake River.

A gross nonpoint source temperature load allocation has been established at no greater than 0.14 ^{o}C for tributaries discharging to the SR-HC TMDL reach. This is equal to the sum of the waste load allocation and the load allocation for anthropogenic tributary sources. This allocation applies at the inflow to the Snake River in the SR-HC TMDL reach, during those periods of time that the site potential temperature in the mainstem Snake River is greater than 17.8 ^{o}C. For this TMDL, there was neither time nor resources to specifically analyze anthropogenic loads in the individual tributaries. Both IDEQ and ODEQ, however, will evaluate these loads when tributary-specific temperature TMDLs are completed. If the calculations of tributary heat loads are significantly different from those determined in this TMDL, the load allocations will be adjusted accordingly.

It should be noted that no explicit load allocation is provided to natural background due to the form of the load capacity.

4.0.6.3 SALMONID SPAWNING DESIGNATED BENEFICIAL USES

The temperature target identified for the protection of salmonid spawning when aquatic species listed under the Endangered Species Act are not present or, if present, a temperature increase would not impair the biological integrity of the Threatened and Endangered population, is less than or equal to a maximum weekly maximum temperature of 13 ^{o}C (when and where salmonid spawning occurs) if and when the site potential is less than a maximum weekly maximum temperature of 13 ^{o}C (temporary rule, effective by action of the IDEQ board 11-14-03, pending approval by Idaho Legislature 2005, subject to US EPA action). If and when the site potential is greater than a maximum weekly maximum temperature of 13 ^{o}C, the target is no more than a 0.14 ^{o}C increase from anthropogenic sources. (The State of Oregon definition of no measurable increase (0.14 ^{o}C) was used, as it is more stringent than the State of Idaho definition of 0.3 ^{o}C.)

When aquatic species listed under the Endangered Species Act are present and if a temperature increase would impair the biological integrity of the Threatened and Endangered population then the target is no greater than 0.14 ^{o}C increase from anthropogenic sources.

This target applies only when and where salmonid spawning occurs and is specific to those salmonids identified to spawn in this area, namely fall chinook (October 23rd through April 15th) and mountain whitefish (November 1st through March 30th). The salmonid spawning target applies from RM 247 to 188. The critical period for salmonid spawning in the Downstream Snake River segment (RM 247 to 188) is from October 23 to April 15. This period is protective of both fall chinook and mountain whitefish.

The start of fall chinook spawning was identified using data collected by IPCo and USFWS from 1991 through 2001. The information and methodologies used to identify the spawning period is discussed in detail in Section 3.6.1.2. Chinook spawning does not occur above Hells Canyon Complex as the Complex represents a barrier to upstream migration.

Point Sources.

There is one permitted, point source discharge to the Downstream Snake River segment (RM 247 to 188). This discharge is for turbine cooling water from Hells Canyon Dam. Current discharge limits are 7.5 MGD, temperature not to exceed background + 10 ^{o}F. Due to the very small temperature loading associated with this discharge as compared to the total outflow of Hells Canyon Dam, no additional permit limits will imposed on this discharge at this time. The waste load allocation for this source will be set at the existing NPDES permit limits. If further information or understanding of the SR-HC TMDL system identifies a need for temperature reductions specific to this discharge, the permit requirements will be revisited as part of the iterative TMDL process.

Nonpoint Sources.

Water temperature modeling by IPCo shows that even if the inflowing water temperature were less than or equal to numeric criteria for salmonid rearing/cold water aquatic life uses, the water exiting the Hells Canyon Complex would not meet the salmonid spawning criteria (although by only a small margin) because of the temporal shift created by the Hells Canyon Complex. Data assessment and calculational modeling by the DEQs (as discussed earlier) have identified a similar trend. It is, therefore, concluded that the responsibility for exceeding the salmonid spawning criteria is specific to the presence and operation of the Hells Canyon Complex dams.

Available water temperature data show that numeric salmonid spawning targets are exceeded during the first few weeks of the spawning period for fall chinook for some years. Limited data collected in the 1950's suggest that criteria were also exceeded before the completion of the Hells Canyon Complex dams in the 1950's, but for a shorter period of time (Figure 3.6.4 a). At those times when exceedences occur, a reduction in thermal loading is needed to bring water temperature during spawning down to the 13 °C daily maximum temperature or to site potential temperatures as defined at RM 345. The critical period for this portion of the temperature TMDL begins on October 23 of each year and extends through the spawning period as long as water temperatures at the outflow from Hells Canyon Dam are 13 °C (daily maximum) or greater.

The 13 °C daily maximum temperature target is utilized as an instantaneous measurement that can be applied in "real time" to determine compliance. Calculation of a daily average temperature would create a time lag in the measurement of ΔT and the management of operations to achieve the target value. This situation could result in short-term exceedences within the outflow.

The site potential comparison approach (water temperatures at RM 345 above Brownlee Reservoir compared to water temperatures at RM 247 below Hells Canyon Dam (1992 to 2001)) is at present the best available estimate of the effect of the Hells Canyon Complex dams on water temperature in the Snake River below Hells Canyon Dam.

The temperature change required by the thermal load allocation consists of a change in water temperature such that the temperature of water released from Hells Canyon Dam is less than or equal to the water temperature at RM 345, or the 13 °C daily maximum temperature target for salmonid spawning. Specific compliance parameters for meeting this load allocation will be defined as part of the 401 Certification process. Figure 4.0.2 outlines this temperature load allocation as calculated from daily maximum temperatures averaged from 1991 through 2001.

The actual excess thermal load (allowable load) is flow dependent. It may be nominally calculated by: flow x ΔT x K, where flow is the discharge rate at any time of concern; ΔT is the difference between the observed temperature at the outflow of Hells Canyon Dam (RM 247) and the target temperature; and K is a conversion factor taking into account the time period of interest, units of energy, and heat capacity and density of water, such as to express a thermal load in terms of energy/time.

Load (kcal/day) = [ΔT x Q_R x (86400 sec/day) x (62.4#water/ft^3)]/ (1.1 x (3.968 BTU/kcal)

where: ΔT = allowable change in temperature
(When river temperatures below Hells Canyon Dam are greater than 13 °C (daily maximum), ΔT is no more than 0.14 °C increase over site potential temperature at RM 345)
Q_R = flow in the river in cfs
1.1 = safety factor of 10 percent

The entire thermal load allocation consists of the required change in temperature (such that the temperature of water released from Hells Canyon Dam is less than or equal to the flow-weighted average temperature at RM 345, or the 13 °C daily maximum temperature target for salmonid spawning) and the allowable temperature change described by the preceding equation. The entire load for the Downstream Snake River segment (RM 247 to 188) is allocated to the Hells Canyon Complex of dams owned and operated by IPCo.

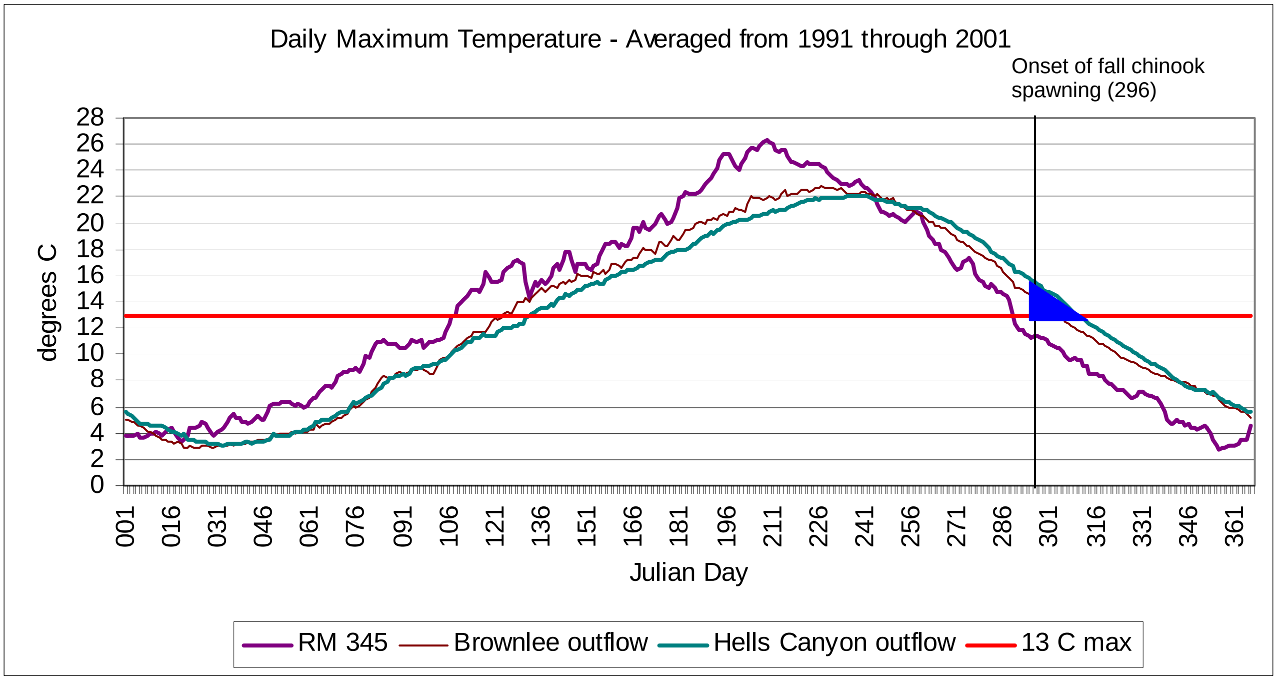

Figure 4.0.2 Load allocation for temperature change below Hells Canyon Dam using a comparison of daily maximum water temperatures for the Snake River at RM 345 (10 miles upstream of the headwaters of Brownlee Reservoir) which acts as the "thermal site potential" surrogate for the Hells Canyon Complex, and water temperatures at the outflow of Hells Canyon Dam (RM 247). (The horizontal line describes the 13 °C maximum allowable temperature that applies from October 23 (Julian day 296) through April 15 (Julian day 105) for Hells Canyon fall chinook. The vertical line identifies the start of salmonid spawning period (October 23, Julian day 296). The triangle describes the mean temperature change necessary to meet the temperature load allocation below Hells Canyon Dam, RM 247).

In the plot in Figure 4.0.2, the 13 °C salmonid spawning temperature target for the SR-HC TMDL is identified, as is the change in temperature required at the outflow of Hells Canyon Dam to meet the target (no greater than 13 °C maximum weekly maximum water temperature) or less than 0.14 °C increase due to anthropogenic influences from the water temperature at RM 345 (the thermal potential surrogate for the Hells Canyon Complex). The data plotted are the mean values derived from water temperature data collected from 1991 through 2001. The maximum temperature change illustrated by this data would be 2.6 °C (occurring on October 23rd) the minimum change would be 0 °C (occurring on Nov 6th). The mean temperature change described by the plotted data is 1.3 °C. The mean duration of the required change described by the plotted data is 14 days.

The development of this load allocation, like the TMDL, is an iterative process. This load allocation will remain in effect until such time as additional data and further analysis warrant its reconsideration and the load allocation is changed through an appropriate process. This thermal load is a load allocation; it is not a waste load allocation. By the use of the term load allocation, however, the DEQs do not waive their right to assert in any proceeding related to this TMDL, the Hells Canyon Hydro-Electric Complex or any other TMDL or hydro-electric project, that a hydro-electric project is a point source under the federal Clean Water Act. Should sufficient data become available to allow an accurate determination of natural warming for the Hells Canyon Complex, this information will be reviewed as part of the iterative TMDL process and revisions to the TMDL and the associated load allocation will be made as appropriate.

Data collected by IPCo and USFWS indicate that fall chinook spawning is occurring under existing conditions throughout the 100 mile reach of the Snake River from below Hells Canyon Dam (RM 245) downstream to Asotin WA (RM 145). While this TMDL stops at the confluence of the Salmon River, the entire reach from Hells Canyon Dam downstream to Asotin, WA currently supports (to some extent) salmonid spawning activity. The majority of spawning activity occurs from October 23rd through the first week of December. Currently, the peak of spawning in the river downstream of Hells Canyon Dam occurs when daily mean and maximum water temperatures are between 12 °C and l6 °C.

Data currently available (IPCo, 2001c, 2001e, 2001f) do not identify impairment to fall chinook spawning due to water temperatures in excess of the current criteria occurring in the late fall. Moreover, studies undertaken by IPCo suggest that warmer fall and winter water temperatures can lead to accelerated hatching and fry development, which may provide a survival benefit to out-migrating juvenile fall chinook. However, these data, and their interpretation, are preliminary. If additional data or study further clarify the support status of fall chinook and/or the effects of water temperature on spawning, or result in changes to salmonid spawning criteria, this information will be reviewed as part of the iterative TMDL process and revisions to the TMDL and the associated load allocations will be made as appropriate.

4.0.7 Total Dissolved Gas

A detailed discussion of sources, available data, associated water quality-related concerns and loading is available in Sections 2.2.4.7, 2.3.3.2, 2.3.4.2, 2.3.5.2 and 3.7.

4.0.7.1 LOADING

Elevated total dissolved gas levels are the result of releasing water over the spillways of dams. Spill at Brownlee and Hells Canyon Dams is the only source of elevated total dissolved gas in the SR-HC reach. At this time, voluntary spill does not occur within the Hells Canyon Complex.

Spill at dams occurs only involuntarily, usually as a result of flood control constraints. The magnitude of the exceedence (to some extent) and the total distance downstream of the dam where water was observed to exceed the less than 110 percent of saturation target are observed to be directly related to the volume of the spill.

Observed ranges of total dissolved gas loading to the Oxbow Reservoir (RM 285 to 272.5), Hells Canyon Reservoir (RM 272.5 to 247) and Downstream Snake River segment (RM 247 to 188) are shown in Table 4.0.18.

Table 4.0.18. Total dissolved gas waste loads from sources in the Snake River - Hells Canyon TMDL reach.

Load Type	Location	Load	Estimation Method
Spill from Brownlee Reservoir	Oxbow and Hells Canyon Reservoir Segments	114% to 128%	Monitoring
Spill from Hells Canyon Reservoir	Downstream Snake River Segment	108% to 136%	Monitoring

4.0.7.2 LOAD CAPACITY

In order to ensure that designated aquatic life uses are protected, total dissolved gas concentrations cannot exceed 110 percent of saturation. This concentration therefore defines the load capacity for the Oxbow Reservoir (RM 285 to 272.5), Hells Canyon Reservoir (RM 272.5 to 247) and Downstream Snake River segment (RM 247 to 188) of the SR-HC TMDL reach (Table 4.0.19).

Table 4.0.19. Total dissolved gas load capacity for segments in the Snake River - Hells Canyon TMDL reach.

Segment	Annual Load Capacity
Oxbow Reservoir segment (RM 285 to 272.5)	less than 110% of saturation
Hells Canyon Reservoir segment (RM 272.5 to 247)	less than 110% of saturation
Downstream Snake River segment (RM 247 to 188)	less than 110% of saturation

4.0.7.3 MARGIN OF SAFETY

An implicit margin of safety is incorporated into the SR-HC TMDL total dissolved gas target as it is established as a conservative criterion for the protection of aquatic life designated uses.

4.0.7.4 BACKGROUND/NATURAL LOADING

There are no known natural sources of total dissolved gas that result in substantial loading or standards violations in the SR-HC TMDL reach.

4.0.7.5 RESERVE

No reserve capacity was built into the calculation of load allocations for total dissolved gas.

4.0.7.6 LOAD ALLOCATIONS

Load allocations specific to total dissolved gas exceedences are identified in Table 4.0.20.

Table 4.0.20. Total dissolved gas load allocations for the Hells Canyon Complex reservoirs.

Segment	Load Allocation
Oxbow Reservoir segment (RM 285 to 272.5)	less than 110% of saturation at the edge of the aerated zone below Brownlee Dam*
Hells Canyon Reservoir segment (RM 272.5 to 247)	less than 110% of saturation at the edge of the aerated zone below Oxbow Dam*
Downstream Snake River segment (RM 247 to 188)	less than 110% of saturation at the edge of the aerated zone below Hells Canyon Dam*

* The specific location of compliance points and protocol for monitoring will be determined as part of the Hells Canyon Complex 401 Certification process for each state.

The load allocation can be calculated using the following equation:

Load = (110%)(K)(flow conversion constant)
where K = the gas conversion constant for N_2

This load allocation has been established to ensure that the less than 110 percent of saturation target is attained. This load allocation applies to all discharge flows not exceeding the ten-year, seven-day average flood flow for Brownlee and Hells Canyon Dams, identified by Idaho Power Company as 72,500 cfs. As spill over Brownlee Dam and Hells Canyon Dam (both facilities owned and operated by IPCo) is the sole source of elevated total dissolved gas in the SR-HC TMDL reach, the entire load allocation goes to the Hells Canyon Complex.

If a separate target is established through the FERC, 401 Certification process or other appropriate mechanism, and shown to support the designated beneficial uses, the load allocation will be revised to reflect the new target.

The SR-HC TMDL will proceed toward completing site-specific implementation objectives within 18 months of approval of the TMDL. Data collection is projected to continue throughout the implementation process to determine progress and improve understanding of the SR-HC TMDL system. As this TMDL is a phased process, it is projected that the goals and objectives of this TMDL will be revisited periodically to evaluate new information and assure that the goals and milestones are consistent with the overall goal of meeting water quality standards in the SR-HC TMDL reach.

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4.1 Reasonable Assurance

For watersheds that have a combination of point and nonpoint sources where pollution reduction goals can only be achieved by including some nonpoint source reduction, a reasonable assurance that reductions will be met must be incorporated into the TMDL (EPA, 1991). The SR-HC TMDL will rely on nonpoint source reductions to meet the load allocations to achieve desired water quality and to restore designated beneficial uses. The State of Oregon Water Quality Management Plan and the State of Idaho Implementation Plan (Section 6.0) contain more detailed information on implementation programs that will provide reasonable assurance of implementation.

To ensure that nonpoint source reduction mechanisms are operating effectively, and to give some quantitative indication of the reduction efficiency for in-place BMPs, monitoring will be conducted. The monitoring will not be carried out on a site specific basis for each implemented BMP, but rather as a suite of indicator analyses monitored at the inflow and outflow of the segments within the SR-HC TMDL reach and at other appropriate locations such as the inflow of tributaries. For example, a decrease in total phosphorus over time as monitored at the Boise River inflow to the SR-HC TMDL reach would serve as an indicator that BMPs employed within the Boise River watershed were acting to reduce total phosphorus levels within the tributary water column. This data will be further utilized, in conjunction with flow measurements, to evaluate the overall decrease in total pollutant mass being delivered to the SR-HC TMDL reach.

Concurrent monitoring of mainstem water quality will be undertaken to determine the direct effects of the monitored inflowing concentration trends on mainstem water quality. If instream monitoring indicates an increasing pollutant concentration trend (not directly attributable to environmental conditions) or a violation of standards despite use of approved BMPs or knowledgeable and reasonable efforts, then BMPs for the nonpoint sources activity must be modified by the appropriate agency to ensure protection of beneficial uses (Subsection 350.02.b.ii). This process is known as the "feedback loop" in which BMPs or other efforts are periodically monitored and modified if necessary to ensure protection of beneficial uses. With continued instream monitoring, the TMDL will initiate the feedback loop process and will evaluate the success of BMP implementation and its effectiveness in controlling nonpoint source pollution.

All identified point sources discharging to the Snake River within the SR-HC TMDL reach are permitted facilities administered by the US EPA (Idaho facilities) or the State of Oregon (Oregon facilities). Wasteload reductions can be precipitated by modification of the NPDES permit. However, the load reductions needed to achieve desired water quality and restore full support of designated beneficial uses in the SR-HC TMDL reach will not be achieved in their entirety by upgrades of the point sources.

The states have responsibility under Section 401 of the CWA to provide water-quality certification. Under this authority, the states review the projects to determine applicability to local water-quality issues.

Under Section 319 of the CWA, each state is required to develop and submit a nonpoint source management plan. The nonpoint management program describes many of the voluntary and regulatory approaches the state will take to abate nonpoint pollution sources. Since the development of the original Nonpoint Management Programs, revisions of the water-quality standards have occurred. Many of these revisions have adopted provisions for public involvement, such as the formation of Basin Advisory Group (BAGs) and WAGs (Idaho Code 39-3614, 3615, 39-3601, 39-3616), as discussed in section 2.0.5.1. The WAGs (SR-HC PAT) are to be established in high priority watersheds to assist DEQ and other state agencies in developing TMDLs and Watershed Management Plans (WMPs) for those segments.

The State of Idaho and State of Oregon water-quality standards refer to other programs whose mission is to control nonpoint pollution sources. Some of these programs and responsible agencies are listed in Tables 4.1.1 and 4.1.2.

Table 4.1.1 State of Idaho regulatory authority for nonpoint pollution sources.

Citation	IDAPA Citation	Responsible Agency
Rules governing forest practices	16.01.02350.03(a)	Idaho Department of Lands
Rules governing solid waste management	16.01.02350.03(b)	Idaho Department of Health and Welfare
Rules governing subsurface and individual sewage disposal systems	16.01.02350.03(c)	Idaho Department of Health
Rules and standards for stream channel alteration	16.01.02350.03(d)	Idaho Department of Water Resources
Rules governing exploration and surface mining operations in Idaho	16.01.02350.03(e)	Idaho Department of Lands
Rules governing placer and dredge mining in Idaho	16.01.02350.03(f)	Idaho Department of Lands
Rules governing dairy waste	16.01.02350.03(g) or IDAPA 02.04.14	Idaho Department of Agriculture

The State of Idaho uses a voluntary approach to control agricultural nonpoint sources. However, regulatory authority can be found in the state water-quality standards (IDAPA 16.01.02350.01 through 16.01.02350.03). IDAPA 16.01.02054.07 refers to the Idaho Agricultural Pollution Abatement Plan (IAPAP) (IDHW, SCC, EPA; 1993) which provides direction to the agricultural community for approved BMPs. As a portion of the IAPAP, it outlines responsible agencies or elected groups (SCDs) that will take the lead if nonpoint pollution problems need addressing. For agricultural activity it assigns the local SCDs to assist the landowner/operator to develop and implement BMPs to abate nonpoint pollution associated with the land use. If a voluntary approach does not succeed in abating the pollutant problem, the state may provide injunctive relief for those situations that may be determined to present imminent and substantial danger to public health or environment (IDAPA 16.01.02350.02 (a)).

If a nonpoint pollutant(s) is determined to be impacting beneficial uses and the activity already has in-place referenced BMPs, or knowledgeable and reasonable practices, the state may request the BMPs be evaluated and/or modified to determine appropriate actions. If evaluations and/or modifications do not occur, injunctive relief may be requested (IDAPA 16.01.02350.2, ii (1)).

Table 4.1.2 State of Oregon regulatory authority for nonpoint pollution sources.

Citation	Citation	Responsible Agency
Rules governing forest practices	ORS 527.710, ORS 527.765, ORS 183.310, OAR 340-041-0026, OAR 629-635-110, and OAR 340-041-0120	Oregon Department of Forestry
Rules governing solid waste management	ORS 459, ORS 459a, OAR 340-093-0005 through 340-096-0050	Oregon Department of Environmental Quality
Rules governing subsurface and individual sewage disposal systems	ORS 454.600,OAR 340-71, OAR 340-73	Oregon Department of Environmental Quality
Rules and standards for stream channel alteration	ORS 196.800-196.990, ORS 390.805-390.925, OAR 141-085-0005 through 141-085-0666	Oregon Division of State Lands
Rules governing exploration and surface mining operations in Oregon	ORS 517.010-517.950, OAR 632-030-0005 through 0007	Oregon Department of Geology and Mineral Industries
Rules governing placer and dredge mining in Oregon	ORS 517.010-517.950, OAR 141-085-0005 through 0085, OAR 141-100-0000 through 0090	Oregon Division of State Lands
Rules governing dairy waste and other CAFOs	ORS 468B.200-468B.230;OAR 340-51, ORS 603-074-0005 through 603-074-0080	Oregon Department of Agriculture

The Oregon Department of Agriculture has primary responsibility for control of pollution from agriculture sources. This is accomplished through the Agriculture Water Quality Management (AWQM) program authorities granted ODA under Senate Bill 1010 Adopted by the Oregon State Legislature in 1993. The AWQM Act directs the ODA to work with local farmers and ranchers to develop water quality management plans for specific watersheds that have been identified as violating water quality standards and have agriculture water pollution contributions. The agriculture water quality management plans are expected to identify problems in the watershed that need to be addressed and outline ways to correct the problems.

It is expected that a voluntary approach will be able to achieve load allocations needed for the SR-HC TMDL. Public involvement along with the eagerness of the agricultural community has demonstrated a willingness to implement BMPs and protect water quality. In the past, cost-share programs have provided the agricultural community technical assistance, information and education (I & E), and the cost share incentives to implement BMPs. The continued funding of these projects will be critical to achieving the load allocations identified in the SR-HC TMDL.

In 1995 the State of Idaho passed Senate Bill 1284, now incorporated into the Idaho Code Section 39-3613 and Section 39-3615. This bill established the formation of the WAGs and BAGs to assist state and federal agencies with water-quality planning in high priority watersheds. The Snake River – Hells Canyon Public Advisory Team (SR-HC PAT), which functions as the WAG for the SR-HC TMDL reach, was formed in March of 2000 in response to Idaho Code Section 39-3615 and public interest in the development of a TMDL for the SR-HC reach. The SR-HC PAT was recognized as the representative body for the watershed by DEQ in that same year.

4.1.1 Forestry Practices

The Idaho Forest Practices Act was passed in 1974 (revised 1992; Title 38, Chapter 13, Idaho Code). Rules that implement the Act establish required minimum BMPs for forestry practices to protect state water quality. In addition to logging, forestry practices include road construction, slash management and other activities associated with silviculture. The rules, which govern activities on Forest Service, private and state lands, primarily address sediment and erosion of streams impacted by logging activity. Reductions in the export of nutrients are not directly assessed; rather, they are addressed through reduction in sediment and sediment transport. Moreover, forestry BMPs do not address the export of nutrients and sediment caused by land disturbing activities that occurred prior to 1974. However, Boise and Payette National Forests, and Idaho Department of Lands (IDL), in conjunction with Boise Cascade Corporation have jointly developed the Forestry Source Plan (1998) to achieve load reductions. The Forests have also identified a method to determine sediment and phosphorus yield from roads and landslides and have developed a list of forestry practice BMPs and treatments with an estimate of their effectiveness in reducing phosphorus (sediment).

The Oregon Department of Forestry (ODF) is the designated management agency for regulation of water quality on non-federal forested lands in Oregon. The Oregon Board of Forestry has adopted water protection rules, including but not limited to OAR Chapter 629, Divisions 635-660, which describe BMPs for forest operations. These rules are implemented and enforced by ODF and monitored to assure their effectiveness. The Environmental Quality Commission, Board of Forestry, ODEQ, and ODF have agreed that these pollution control measurers will be relied upon to result in achievement of state water quality standards. ODF provides on the ground field administration of the Forest Practices Act (FPA). For each administrative rule, guidance is provided to field administrators to insure proper, uniform and consistent application of the Statutes and Rules. The FPA requires penalties, both civil and criminal, for violation of Statutes and Rules. Additionally, whenever a violation occurs, the responsible party is obligated to repair the damage.

Current forestry BMPs in Oregon and Idaho will remain as each state’s forestry component of the TMDL.

4.1.2 Agricultural Practices

For agricultural activities in Idaho there are no required BMPs. Consequently, agricultural activities must use knowledgeable and reasonable efforts to achieve water-quality standards. Generally, voluntary implementation of BMPs would be considered a knowledgeable and reasonable effort. A list of recommended BMP component practices which when selected for a specific site become a BMP, has been published in the Idaho Agricultural Pollution Abatement Plan (1991). To facilitate use of these practices, a variety of state and federal funding sources are available to provide cost share incentives. Projects are directed at improving water quality through control of nonpoint source pollution at the subwatershed level using BMPs developed by the Natural Resources Conservation Service (NRCS). Cost share funds are dispersed to private landowners through local Soil Conservation Districts. Contracts with landowners require that BMPs be implemented for ten years, but changes in management practices should provide longer-term benefits. Currently, BMPs are directed at changes in irrigation practice, fencing or other access-restriction of riparian areas, creation of wetland habitat, establishment of off-site watering facilities and related practices.

In Oregon it is the Oregon Department of Agriculture's (ODA) statutory responsibility to develop agricultural water quality management (AWQM) plans and enforce rules that address water quality issues on agricultural lands. The AWQM Act directs ODA to work with local farmers and ranchers to develop water quality management area plans for specific watersheds that have been identified as violating water quality standards and having agriculture water pollution contributions. The agriculture water quality management area plans are expected to identify problems in the watershed that need to be addressed and outline ways to correct those problems. These water quality management plans are developed at a local level, reviewed by the State Board of Agriculture, and then adopted into the Oregon Administrative Rules. It is the intent that these plans focus on education, technical assistance, and flexibility in addressing agricultural water quality issues. These plans and rules will be developed or modified to achieve water quality standards and will address the load allocations identified in the TMDL. In those cases when an operator refuses to take action, the law allows ODA to take enforcement action. ODEQ will work with ODA to ensure that rules and plans meet load allocations.

4.1.3 Monitoring

A rigorous monitoring plan and schedule is critical to the SR-HC TMDL. There is no way to determine progress, define trends, fill data gaps or enlarge understanding without an understanding of the changes occurring in the system. The State of Idaho includes a monitoring plan in all TMDL implementation plans prepared in the state. By including this plan in the implementation plan, it allows greater opportunity for ground-truthing and interagency participation. It also allows the monitoring plan to be constructed with a better understanding of the implementation activities that will be undertaken, and where and when these activities will occur so that monitoring can be tailored to the needs of the system as well as tracking the improvements that will be made.

These implementation plans are completed in much the same way as a TMDL is put together, with public, agency and stakeholder input. They are reviewed in a public process and comments are responded to.

Given this understanding, a monitoring plan that is appropriate in scope will be prepared as part of the site-specific implementation plans completed 18 months following the approval of the SR-HC TMDL. IDEQ has an acknowledged role in construction of this plan and oversight of the monitoring activities. In other TMDLs in the State of Idaho, IDEQ monitoring has played a prominent role in progress evaluation. Other entities, such as state and federal agencies have also often been partners in providing monitoring support for TMDL implementation. It is expected that the monitoring accomplished on the SR-HC TMDL will follow a similar pattern of participation. ODEQ has committed to participate to the fullest extent possible contingent on available resources.

The implementation of the SR-HC TMDL and the correlated system response is projected to be a lengthy process lasting several decades. Therefore it is critical that a schedule for long-term monitoring be committed to. In order to accomplish this, the general level of monitoring will need to be tailored in such a way that a sustainable level of routine monitoring can be accomplished while still allowing site-specific response to immediate conditions. For example, routine chlorophyll *a* monitoring should be scheduled at a frequency that will allow trend identification but should not be undertaken at a frequency that will make the assessment of a specific bloom impossible due to budget constraints.

While detailed plans cannot be accurately identified at this time, the monitoring effort on the SR-HC TMDL is expected to include (at minimum):

MONITORING TO FILL DATA GAPS

Constituents:

- Dissolved Oxygen at the sediment/water interface in the Upstream Snake River segment, mercury (water column), pesticides (Oxbow Reservoir), sediment (duration data)

Schedule:

- Final evaluations completed within the first phase of implementation

ROUTINE PROGRESS MONITORING

Constituents:

- Phosphorus, nitrogen, dissolved oxygen, chlorophyll *a*, sediment, temperature

Locations:

- Monitoring points located upstream and downstream in the defined TMDL segments, namely Upstream Snake River (RM 409 to 335), the Reservoir Complex (RM 335 to 247), and Downstream Snake River segments (RM 247 to 188). As Brownlee Reservoir (RM 335 to 285) acts not only as the source water for the downstream reservoirs, but also as the recipient of upstream waters where water quality objectives will have a noticeable influence if attained, it is expected that a greater level of monitoring will be focussed on Brownlee Reservoir than on Oxbow or Hells Canyon reservoirs.
- Monitoring of major tributaries at their inflow to the SR-HC TMDL reach

Schedule:

- Routine monitoring frequency is projected to occur monthly or (at minimum) seasonally as water quality needs require.
- Monitoring of major tributaries at their inflow to the SR-HC TMDL reach on a monthly or (at minimum) a seasonal basis to determine loading trends.

These projected goals of the SR-HC monitoring plan will be a joint effort on the part of many government and private participants. Specific responsibility will be identified as the implementation planning process proceeds.